VEMBER 1959 VOLUME 8 . NUMBER 11

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IN THIS ISSUE: Toward a New Science of Metallurgy

Writings by STAFF Members

American Society for Metals, Transactions, v. 51, contains the following papers by staff members:

High-Temperature Oxidation and Contamination of Niobium. William D. Klopp, Chester T. Sims, and Robert I. Jaffee, Preprint No. 64, August 7, 1957, 27 pp.

The oxidation and contamination rates of niobium in oxygen and in air were measured in the temperature range 600 and 1200 C. The oxidation curves in oxygen were linear and the rate constants were correlated by an Arrhenius-type plot. The heat of reaction was 5,410 cal per mole from 600 to 1100 C; above 1100 C the reactions were rapid and the rates could not be correlated to the Arrhenius-type plot. The activation energy for diffusion of oxygen in niobium was calculated from contamination data. Weight-change curves of niobium in air were also linear, with lower rates than in oxygen. The heat of reaction was, from the reaction rate data, 10,100 cal per mole from 600 to 1200 C. Contamination in air-reacted niobium was similar to that in oxygen-reacted niobium, suggesting that oxygen is the primary diffusing contaminant.

Studies of the Oxidation and Contamination Resistance of Binary Niobium Alloys. Chester T. Sims, William D. Klopp, and Robert I. Jaffee, Preprint No. 70, August 1, 1957, 33 pp.

A study of the effects of binary alloying additions on the oxidation and contamination resistance of niobium has been conducted. The alloys contained up to 35 a/o titanium, chromium, and zirconium, 25 a/o vanadium, molybdenum, tantalum, and tungsten, and 5 a/o beryllium, boron, cobalt, iron, manganese, nickel, and silicon. The oxidation and contamination studies were conducted in air at 600, 800, and 1000 C. Contamination was investigated by hardness-penetration measurements on all oxidized alloys except those containing beryllium or boron. Zirconium and titanium markedly reduced the depth of oxygen contamination resulting from exposure to air. Diffusion coefficients for oxygen in the niobium binary alloys were calculated, and related by activation-energy plots where possible. Zirconium, titanium, chromium, and vanadium were most effective in reducing oxygen diffusion into niobium.

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

Electroclad Aluminum on Uranium. John G. Beach and Charles L. Faust. *Electrochemical Society, Journal*, August, 1959, pp. 564-659.

Electroplating of aluminum was studied as an alternative method for aluminum cladding of uranium fuel elements. Uranium electroclad with 12 mils of aluminum over a 0.5-mil nickel or nickel-plus-copper electroplate resisted corrosion for more than 100 hours in boiling water. Hot pressing the electroclad composite improved the corrosion resistance. Many of the aluminum electrocladding results paralleled those obtained with wrought aluminum claddings on uranium.

The Availability, Recovery, and Properties of Rhenium Metal. Ivor E. Campbell, D. M. Rosenbaum, and B. W. Gonser. *Journal of the Less Common Metals*, June, 1959, pp. 185-191.

Rhenium, a relatively new and unknown metal, is inherently rare and probably will continue to be expensive. However, at least a few thousand pounds can be readily obtained yearly as a by-product from molybdenum concentrates. Its extremely high melting point and good metal properties indicate a growing use for those applications where a relatively high cost can be tolerated.

Reliability Engineering, Today and Tomorrow. Kenneth E. Cochran. *Tooling & Production*, August, 1959, pp. 37-40.

Reliability engineering is essentially a predictive science. It is concerned with the prediction of how long equipment will last in a specific environment. It also provides the techniques for developing products with a designated life span, and for improving products to meet higher requirements. Materials, production processes, and quality control measures must also be considered when the proposed product reaches the manufacturing stage.

Fluid-Flow Models Predict Design Performance. A. A. Putnam and E. W. Ungar. *Product Engineering*, August 17, 1959, pp. 64-66.

Flow of gases and liquid through passage and around obstructions is often difficult to predict on paper. Models are used to check design calculations, and to make sure that the fluids will behave as planned.

Elevated-Temperature Properties of Chromium Steels (12-27 per cent). Ward F. Simmons and Howard C. Cross. 113 pp., 1958, American Society for Testing Materials, Philadelphia.

Presents summary curves for tensile strength; 0.2 per cent offset yield strength; per cent elongation and reduction of area; stresses to produce rupture in 100, 1000, 10,000, and 100,000 hours; and stresses for creep rates of 0.00001 and 0.00001 per cent per hour (one per cent in 10,000 and 100,000 hours). Data for 23 steels ranging from 12 to 27 per cent chromium are given.

Suppression of Oscillations in Gas-Fired Residential Heating Equipment. C. F. Speich and A. A. Putnam. *American Society of Heating, Refrigeration, and Air Conditioning Engineers Journal*, August, 1959, pp. 41-45.

Techniques for the suppression of oscillations in gas-fired heating equipment utilizing burners of both single- and multiple-port type.

BATTELLE TECHNICAL REVIEW

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Dedicated to the dissemination of knowledge. Published monthly by Battelle Memorial Institute, an endowed foundation serving mankind through science and technology.

Please address all correspondence about articles, abstracts, subscriptions, and exchanges to: The Editor, Battelle Technical Review, Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio.
Accepted as controlled circulation publication at Columbus, Ohio.
Printed in U. S. A.

VIGNETTE

ROBERT I. JAFFEE

The past decade has seen a revolution in metallurgy, states Robert I. Jaffee, brought about by creation of new theories and the broadening of the area in which metallurgists work. He believes that three developments have played leading roles in moving the field further from "cookbook" to scientific methods—increased knowledge of deformation and fracture (largely through application of dislocation theory); strengthening of metals by stable dispersions, controlled grain and subgrain structure, and phase transformation; and the replacement of qualitative by quantitative methods. He also points out that accompanying this revolutionary burst has been the emergence of the less common metals to practical usefulness, perhaps each stimulating the other.

It is no exaggeration to say that Bob has been among the pioneers of this great change. Research contributions by Bob and his colleagues, can only be summarized. Their far-reaching work on titanium has led to the development of many of the titanium alloys now in commercial use. And their studies were among the earliest to reveal the significance of hydrogen in titanium embrittlement. They are currently concerned with refractory metals, particularly columbium, although tungsten, molybdenum, zirconium, and others have been receiving intensive study. The strengthening of conventional metals—lead, copper, zinc, tin, cobalt, and others—by dispersion is among Bob's interests. As is the development of clad and composite structural materials for space-age needs.

Bob's research activities are partly reflected in the more than one hundred papers and publications bearing his name and the almost three-dozen patents based on his contributions.

Chief of Battelle's nonferrous physical metallurgy division, Bob has been named to numerous professonal and technical posts. Already chairman of the Alloy Selection Group of the Titanium Alloy Sheet Rolling Panel and chairman of the Molybdenum Applications Group of the Refractory Metals Panel—both of the Materials Advisory Board, National Academy of Sciences—he has just been named to the Board's Refractory Metals Sheet Rolling Panel. Last month he served as chairman of the Newer Metals Symposium of the American Society for Testing Materials. Bob is also active in the American Society for Metals, the American Institute of Mining, Metallurgical and Petroleum Engineers, and Institute of Metals (London).

A B.S. in chemical engineering, Illinois Institute of Technology, an M.S. in metallurgy from Harvard, and a Ph.D. degree from the University of Maryland constituted Bob's formal training. He joined Battelle in 1944, following service as a physical metallurgist with Leeds and Northrup and the University of California at Berkeley.

When Bob gets away from research, he likes to relax with his family. He and his wife, Edna, along with sons Bill (11) and Mike (4) enjoy camping and vacationing in the Pacific Northwest. At home, Bob's favored activities are golf, first, and then fishing and gardening.

Important to the advancement of metallurgical science are methods for making quantitative what has heretofore been qualitative. The author describes important newer quantitative techniques and discusses their significance.

Toward a New Science of Metallurgy

by ERVIN E. UNDERWOOD

"I often say that when you can measure what you are speaking about and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of science, whatever the matter may be."

Lord Kelvin

IN THE EVOLUTION OF THE vast complex of products and processes that make up our modern civilization, it is the rule that art precedes science. Man usually learns *how* before he learns *why*. Metals and alloys that have been made and used for thousands of years have been subjected to scientific study for only a few decades.

Perhaps the greatest progress toward the scientific development of metallurgy has occurred in that branch known as "physical metallurgy"—the study of the internal structure of metals and alloys, as well as the relation of this structure to composition and to physical and mechanical properties. This progress has been due in large measure to the wedding of modern physics—its tools and its concepts—to the problems of physical metallurgy. Foremost in this regard, of course, are the

1. *Lineal analysis is performed on specimens moving under the microscope. Stopping and starting and speed of the movement are controlled by buttons on the Hurlbut counting box attached at the right of the microscope. The length of the traverse for each constituent can be tallied separately. The inset photomicrograph illustrates what the operator sees.*

far-reaching developments of dislocations (imperfections in metallic crystals) and resulting theories, whereby entire new fields of metal science have been revealed.

Somewhere in the background of these new, exciting advances in metallurgical research and theory are the old, "classical" methods of metallurgical experimentation. These methods have remained substantially unaltered since their earliest days. For example, metallography, which is concerned with the examination and identification of the microstructural constituents in metals and alloys, has changed but little since the introduction of the metallurgical microscope.

It is to a relatively new development in the art of metallography that this article is mainly devoted. Appropriately enough, it is called "quantitative metallography". Simply speaking, what before was only expressed qualitatively or estimated subjectively can now be measured quantitatively.

What Quantitative Metallography Can Do

Through the use of quantitative techniques, such important features of metallic microstructure as grain size, volume per cent of the alloy constituents, and mean particle spacing can be expressed in numbers. Furthermore, the benefits accruing from the application of quantitative methods to metallurgy can also be obtained in many other scientific and technological fields. Of interest are the volume per cent of air-bubble voids in frost-resistant concrete, the characteristics of flakes in paints, the types and amounts of minerals in rocks, the density of sintered ceramics, and many other applications where quantitative measurements are needed.

Actually, these "new" methods are based on the old mathematical derivations of Delesse and Rosiwal, and on the applications to specific problems by C. S. Smith, R. L. Fullman, E. Scheil, and S. A. Saltykov, to name a few. M. Cohen's adaptation of C. Hurlbut's mechanical counting device to the study of metallurgical structures can be said to have ushered in the new science of quantitative metallography.

Only the newer aspects of this metallurgical science are stressed in this paper, even though some quantitative methods have been used in the past. For instance, the volume fraction of a constituent of an alloy has been determined from photomicrographs by cutting out the sections showing the constituent of interest and comparing the weight of the pieces to the total weight of the photo. Needless to say, a person would encounter severe difficulties with a complex microstructure. Such laborious, and often inaccurate, methods have been superseded by modern techniques and mechanized apparatus that provide greater accuracy in a shorter time.

Of the many general and important applications of quantitative metallography, perhaps three items deserve most attention. They involve the determination of volume fraction of constituents in an alloy, the grain size, and the mean particle spacing in particulate alloys. The three types of measurements that are required and the fundamental equations will be discussed first; then specific applications of these methods to new problems that have arisen through research at Battelle will follow. This brief article is not entirely a review, since new ideas and modifications are suggested here that have not been published before.

The Basic Equations of Quantitative Metallography

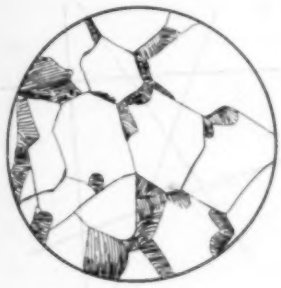
Many of the problems dealt with by the methods of quantitative metallography have arisen because of the opacity of metals. This inability to look through a metal has forced us to deal with the two-dimensional surface (the "plane of polish" in metallurgical parlance). Equations developed by mathematicians have made it possible to deduce the three-dimensional characteristics from the two-dimensional measurements.

An essential feature of these equations is that their accuracy depends upon an adequate statistical representation of the two-dimensional surface. It is desirable, although not necessary, that randomness of structure be attained physically, else additional measurements must be taken to account satisfactorily for the lack of randomness.

The amount of time involved in collecting adequate data increases as the structures depart from random-

Dr. Underwood is deeply engaged in the study of the fundamental behavior of metals and alloys at high temperatures. The pursuit of these studies has aroused an intense interest in finding better techniques for gathering effective data. In addition to the quantitative methods discussed in the present article, the author has pioneered methods of correlating short-time hot-hardness values with long-time creep data. In his research at Battelle, Underwood has successfully utilized careful quantitative measurements with the study of simple, high-purity alloys to clarify the mechanisms of deformation in alloys at high temperatures.

ness, or as the phases of interest become small or closely intermingled. In fact, a prime requisite of quantitative metallographic methods is the ability to distinguish clearly the phases of interest. Furthermore the microstructure must be faithfully reproduced, since small etching effects may introduce large errors. It should be emphasized that, even in the simplest cases, quantitative techniques are still relatively tedious. The value of the results, however, is usually well worth the extra trouble involved.



2. *The volume fraction of a precipitate, f_v, is determined by measuring the length intercepted by the precipitate during a few passes with the Hurlbut counter by utilizing the equation $f_v = L_P/L_T$.*

The basic equation for the volume fraction, f_v, may be expressed simply in terms of lengths, L; areas, A; or volumes, V; such that

$$f_v = \frac{L_P}{L_T} = \frac{A_P}{A_T} = \frac{V_P}{V_T} . \qquad (1)$$

Equation (1) says that the volume fraction equals the length ratio, the area ratio, and, of course, the volume ratio of constituent P to the total, T. So, whether we measure the relative length of a straight line intercepted by a constituent, P, or the relative area, the ratios should equal the volume fraction of that constituent. Of course, the accuracy of Equation (1) is dependent on the measurement of a statistically significant sample.

The experimental procedure followed in determining the volume fraction of precipitate in an alloy may be conducted in the following way. The lineal ratio, L_P/L_T, is conveniently measured on a suitably mounted specimen under the microscope. A movable stage pulls the specimen under the cross-hair, which defines a line across the microstructure. By connecting the movable stage to the Hurlbut counter, the fractional lengths of the line falling over the precipitate are added up; then that sum is compared to the total length of the line. Several of these random traverses are made to attain sufficient statistical representation as shown in Figure 2. Depending on the accuracy desired or needed, more traverses may be made.

Other ways of obtaining the volume fraction are available, such as point counting, planimeter measurements, or "flying spot" photoelectric cell recordings. Point counting has greatest usefulness when the second phase is in a finely divided state. A grid is superimposed over a photomicrograph and the number of grid intersections falling on the selected constituent is counted and compared to the total number of intersections. In effect, this procedure may be thought of as giving a ratio of areas, since the finer the spacing of the grid, the closer the approach to a coverage by areas.

Equation (1) may then be modified, for the case of point counting, to the form:

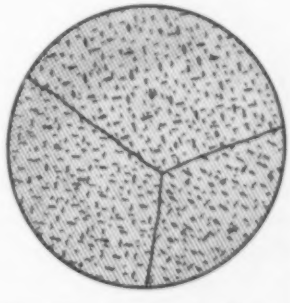
$$f_v = \frac{N_P}{N_T} , \qquad (2)$$

where N_P is the number of grid intersections falling over phase P, and N_T represents the total number of grid intersections.

Measurements of volume fraction can be made on photomicrographs or tracings of a structure by means of a planimeter, provided that the constituents are not too small nor too irregularly shaped. The ratio A_P/A_T of Equation (1) is obtained and gives f_v.

An interesting variation of lineal analysis is embodied in the use of the "flying spot". A photoelectric cell scans a duplex structure and discriminates between light and dark areas. With a constant rate of movement of the spot, the length of time spent over dark areas, for example, divided by the total time of traverse, equals the volume fraction. This method is limited to phases that contrast strongly and are not finely dispersed.

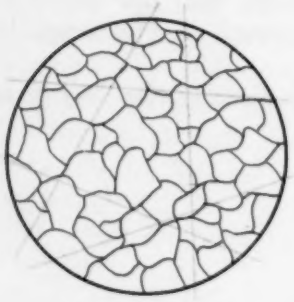
Grain size is another important feature of microstructures that lends itself well to quantitative determination. In this country, the ASTM grain-size charts are used to a great extent. However, the usual subjective comparison between chart and microstructure is incapable of yielding an exact grain-size number, but only a range of numbers. Other criteria are employed to characterize grain size, such as the area of grains, the diameter of a circle with the equivalent area, the average grain length or width or some combination of these, and the average lineal intercept between grain boundaries.



3. *The volume fraction of a fine precipitate may be determined by counting the intersections of the grid that fall over the particles. The volume fraction can then be determined by using the equation $f_v = N_P/N_L$.*

By far the simplest and most useful of the quantita-

tive methods of measuring grain size is the lineal intercept method. All that is needed is a polished and etched specimen, a microscope with a cross-hair, and a movable stage with a distance scale. The specimen is traversed under the the cross-hair, the number of grain boundaries intersected is counted, and the total length of traverse is recorded. The number of grain boundaries intersected is virtually the same as the number of grains, for a large number of grains. The ratio, number of grains to distance traversed, is called N_L, the number of grains per unit length. The reciprocal of N_L gives the mean diameter, frequently expressed in millimeters.



4. *The number of grains per unit length, N_L, is determined by counting the grain boundaries intersected along a number of passes under the microscope. ASTM grain-size numbers are derived by use of the equation $S_v = 2N_L$.*

The practical usefulness of N_L lies in its direct relation to the ASTM grain-size number system. When grain sizes are measured quantitatively, ASTM numbers can be expressed in fractional numbers, if desired. This interrelationship arises through the mathematical expression deduced by Smith and Guttman, between grain-boundary area and grain-boundary intersections, which is simply

$$S_v = 2\,N_L . \qquad (3)$$

S_v is the grain-boundary surface area per unit volume, and N_L is the number of grain boundaries intersected per unit length. The table on page 405 of the *Metals Handbook* lists corresponding values of ASTM numbers (in the first column) and S_v (in the last column) in mm^2/mm^3.*

Simply by measuring N_L, and doubling it to get S_v, one can obtain ASTM numbers that are independent of observer bias and which can be valid down to fractional intervals. The accuracy of this procedure has been verified experimentally by comparing actual values of N_L and ASTM numbers against the data published in the *Metals Handbook*. This experimental verification of the predicted relationship between S_v and ASTM numbers further enhances the utility of the lineal intercept method. Combined with its simplicity, objectivity, and speed, the N_L measurement should find increasing use in technological applications.

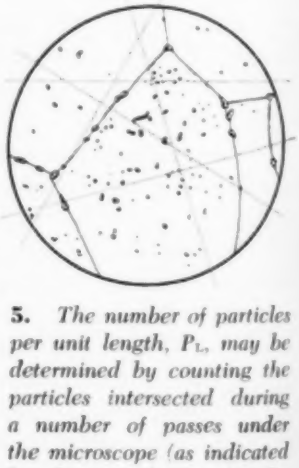
A third area where quantitative measurements can be of service is with those duplex structures where particles, platelets, or second phases are embedded in a matrix. The importance of the particle spacing and the interphasal distance in determining strength is well known. However, some of the techniques previously resorted to for obtaining this spacing leave much to be desired. For example, the ferrite spacing in fine pearlitic steels was determined from the limit of resolution of the pearlitic structures under the microscope.

More modern techniques, utilizing quantitative methods, can now give an unequivocal value to the mean-free path, MFP, between particles (or phases). Use is made of a simple equation which possesses great generality, being independent of the size, shape, or disposition of the second phase. It is

$$\mathrm{MFP} = \frac{1\text{-}f_v}{P_L} , \qquad (4)$$

where P_L represents the number of particles intersected per unit length, and f_v stands for the volume fraction of the particles. P_L is obtained readily by random, straight-line traverses across the microstructure (similar to the way described above for obtaining N_L). The number of particles touching the intersection of the cross-hairs is counted, then divided by the total length of traverse. The volume fraction, f_v, is not obtained so readily, since many fine, small particles make lineal analysis an inaccurate and difficult job. Frequently, in a case like this, point counting is employed with greater accuracy. Great care must be exercised to insure that the particles are not overetched, since a two-fold increase in the apparent particle size can easily result.

A particularly useful quantity, the reciprocal of P_L, is S_p, which represents the mean spacing between particles. The particle spacing, S_p, can be thought of as the mean center-to-center distance between particles, while the mean free path, MFP, can be likened to the mean edge-to-edge distance between particles. It can be seen from Equation 4 that, as the particles become very small, f_v also becomes small, and the value of S_p approaches that of the MFP. Under these conditions, as well as when the particles are very far apart, there is no great advantage in a laborious determina-



5. *The number of particles per unit length, P_L, may be determined by counting the particles intersected during a number of passes under the microscope (as indicated by the straight lines). The mean free path, MFP, can then be calculated from the equation $MFP = 1\text{-}f_v/P_L$.*

*The caption over the last column is inverted, so must be read from bottom to top.

tion of the MFP. The ease with which S_v is obtained, and the fact that the MFP is practically the same as S_v, makes the particle spacing the preferred measurement for many particulate alloys.

Applications of Quantitative Metallography

Techniques of quantitative metallography, described earlier, have been found to provide more dependable and more rapid measurements than have been available before. These methods have been advantageous in finding the volume fractions in polyphase mixtures and in measuring the particle spacings of dispersed phases. Indeed, the application of these methods has resulted in new findings in the relationship of dispersed particles to alloy strength.

Obtaining Volume Fractions of Phases

One of the time-honored ways of obtaining the volume fraction of a phase in a two-phase mixture is by calculation from the phase diagram. If one knows the temperature at which equilibrium is attained in a binary alloy, then the compositions of the two phases can be taken from the phase diagram. Knowing the over-all composition of the alloy and the densities of the two phases, the volume fractions can be calculated. Until the advent of adequate quantitative methods, this procedure was about the only practicable method available.

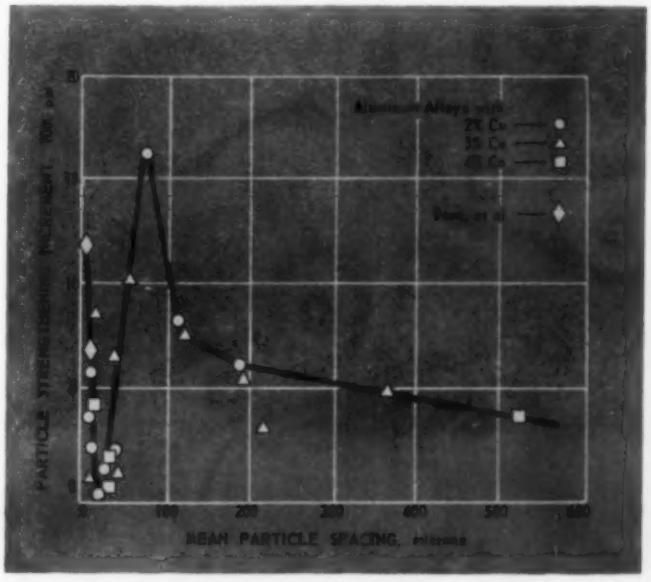
Recent work at Battelle has demonstrated that the assumptions involved and the answers obtained by this method may be incorrect, at least for alloys with small particles. The actual amount of small precipitates far exceeds that predicted by the phase diagram for the aluminum-copper alloys investigated at Battelle. Once this result was established, it was easy to find examples of the same anomalous behavior reported in other cases—unremarked or unsuspected by the authors. It is gratifying to see that this situation has now been recognized and commented upon in more recent articles from other laboratories.

Although the original explanation of this effect was only tentative, it still appears generally valid. First, we know that the phase diagram is constructed for equilibrium conditions, and this implies phases with essentially infinite radii of curvature. Also, well-known nonequilibrium conditions, connected with small particles and finite radii of curvature, operate to give phase limits not normally found in the phase diagram. Thus, there appears to be some basis for acceptance of the anomalous results found by quantitative measurements.

Secondly, the assumption is very often made that the precipitate coming out during age-hardening has the composition dictated by the phase diagram. By postulating that the initial precipitate does *not* have the equilibrium concentration, but rather that it gradually approaches the limiting concentration during precipitation, then the unduly large amount of precipitate observed is easily rationalized. The preceding argument was advanced to explain the original results; however, experimental verification would be welcome. For instance, the electron-probe microanalyzer is capable of measuring the actual concentration of the precipitate particles and providing an unambiguous verdict on the above explanation.

Obtaining Spacings of Particles

In the continual search for stronger and more heat-resistant materials, alloys with dispersed phases are frequently employed to obtain maximum strengthening. It is almost axiomatic that the finer the spacing between particles (or phases), the greater the strengthening effect. Quantitative measurements of particle spacings and their effects in alloys are relatively scarce, and in fact, our belief in this rule is founded on only a few basic investigations. An increasing amount of work is being done in this field, both experimentally and theoretically, and there is a greater emphasis on the quantitative aspects of particle strengthening.



6. *Particle-strengthening in aluminum-copper alloys first declines, then increases, and declines again with the gradual widening of the spacing between dispersed particles. There is little difference between alloys with 2, 3, and 4 per cent copper because only the strengthening due to particles is considered. The results of a study by J. E. Dorn and his co-workers at very small spacings are included for comparison with these findings.*

Unusual findings, unsuspected either by theory or practice, have been made recently in quantitative studies performed on particulate alloys of aluminum-copper. John E. Dorn and co-workers reported an inversion in the strength *versus* temperature curves for an alloy with a fine particle spacing and one with a coarse spacing. In an intermediate temperature range, the alloy with a coarse spacing was stronger than the alloy with a fine spacing.

The effect of variations in particle spacings, out to very wide limits, was reported from Battelle for aluminum-copper alloys. It was found that, if the range of spacings were greatly extended, a critical value was reached, beyond which the strengthening increased again. Heavily overaged alloys were subjected to high-temperature anneals to obtain a wide range of particle spacings. This procedure not only gave particles closely approaching spheres, but also resulted in spacings much larger than ever reported previously. When the strengthening effects in these alloys were plotted *versus* the particle spacings, unusual features were observed, as reproduced in the graph on page 7.

First, as the spacings increase from zero, the usual decrease in strength with wider spacings is observed. However, a minimum occurs at about 25 microns, followed by a totally unexpected strength increase to a maximum near 75 microns. The strength ultimately decreases thereafter, of course, as the particle spacings continue out toward infinitely large. This behavior had not been observed previously, probably because of the greater interest in the finer spacings. The same type of curve was obtained from tensile tests at room temperature as from creep tests at elevated temperatures. Thus, the anomalous strength increase at spacings greater than 25 microns could not be attributed solely to the stress-induced precipitation occurring during creep.

A completely satisfying explanation of these effects is still not forthcoming, although several possibilities have been advanced. In addition to particle strengthening, one must consider the interactions due to grain boundaries, subgrain boundaries, and regions of concentration heterogeneity. The latter factors are known to influence strength properties and could be operative, either singly or in unison, under the unusual conditions obtained here. Suffice it to say that at this time, the most plausible explanation of the strengthening peak at 75 microns postulates a critical interaction of particle and subgrain boundaries. As a matter of practical interest, it was observed that for spherical particles, a maximum strengthening increment of 16,000 psi resulted at a spacing of 75 microns; for platelike particles, 23,000 psi was the maximum noted at a spacing of 15 microns.

There are many other examples that could be quoted to show the diversity, value, and potentialities of quantitative metallographic measurements. Perhaps the most telling argument of all, which reveals the Russian's attitude toward the value of quantitative metallography, is found in the fact that they have recently published an entire book on the subject.* The preceding account has attempted merely to give a brief picture of this rapidly expanding field. It is hoped that new, and possibly remunerative areas for exploration and exploitation have been suggested. Not only are measurements of important quantities put upon a sound quantitative basis, but also the accuracy (and sometimes the speed) is increased. These are considerations that have proved commercially sound and are becoming increasingly indispensable in our modern technology, which is geared to ever more stringent specifications. It is truly the role of the research worker to lead in the development and application of these new methods, for his own advantage as well as for the benefit and future use of industry.

*S. A. Saltykov, *Stereometric Metallography*, Second Edition, Moscow, Metallurgizdat, 1958.

HIGHER GOALS FOR SCIENCE

"Unless American science has a higher goal than the mere production of more machines and materials which will increase our physical comfort, we are sowing the seeds of our destruction. Viewed in that light, the problems of education, both in science and in the humanities, take on a new importance, and they demand the attention of all educated persons."

John C. Bailar, Jr. in his Presidential Address before the 136th Annual Meeting of the American Chemical Society.

An Appraisal of Chromatography

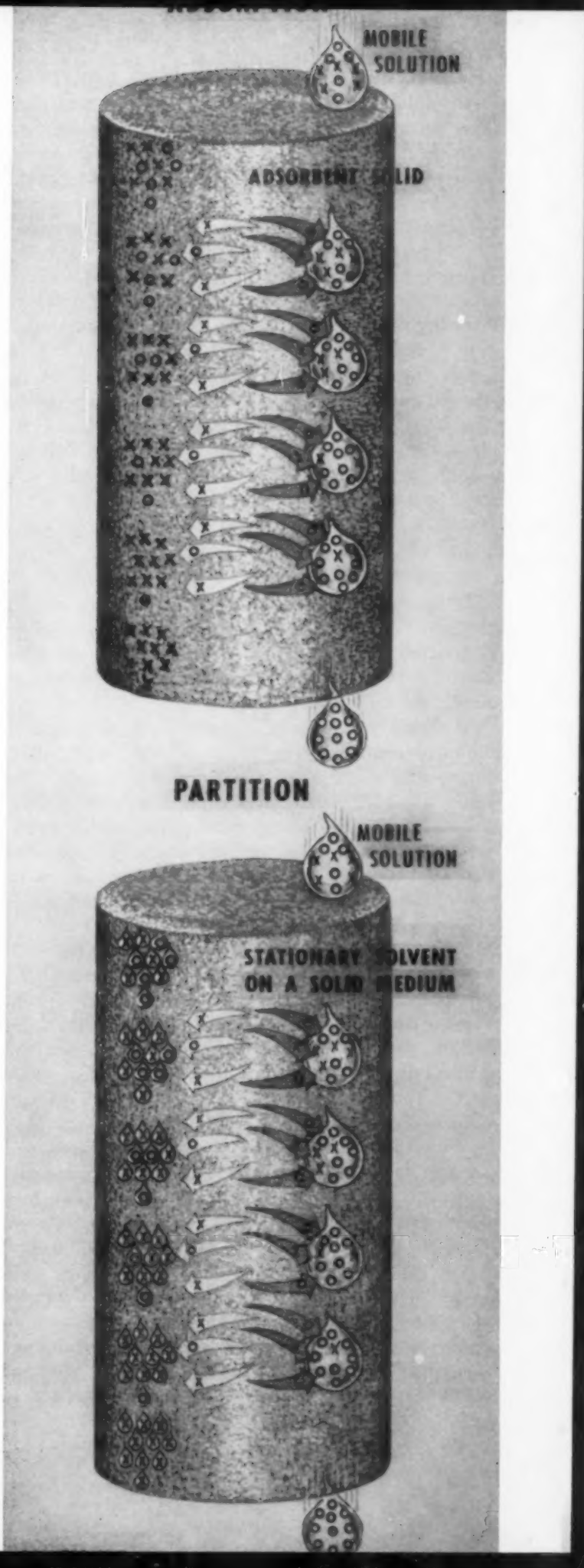
In three decades, chromatography has emerged as an important research tool for the chemist and is entering the production picture. The author describes techniques and applications of adsorption and partition chromatography and discusses their possible future usefulness.

by ROBERT E. FULMER

THE FIRST USE OF chromatography is regarded as having been made near the start of the Christian Era. The Roman, Pliny, recorded the use of papyrus impregnated with gallnut extract for detection of iron sulfate. However, the invention of chromatography is considered to have been revealed in 1906, when Mikhael Tswett described the separation of plant pigments on a column filled with calcium carbonate. At about the same time, independent studies showed that crude oil could be separated into various fractions by passage through a column of fuller's earth. As with many other important scientific discoveries, wide use of the new method was not made for many years.

Twenty-five years after Tswett's first discovery, the scientific climate became favorable to the adoption of chromatography as a research tool. Since then, chromatographic techniques have been refined and modified so that they can be used in production processes. Rapid progress in the fields of vitamins, hormones, toxins, enzymes, proteins, and other natural products has been in large part due to the use of chromatography. This method has also been applied to inorganic compounds.

Named chromatography because it was first used with colored substances, the process is applicable to the separation of mixtures of all types of chemical com-



pounds, including colorless materials. The actual chromatographic process is a technique of separation, that takes advantage of different rates of movement of dissolved substances as they pass through a porous medium. Classical, or adsorption chromatography separates the components of a mixture by distribution between a liquid solvent and an active, porous solid. Liquid partition chromatography distributes the components of a mixture between a liquid solvent held on an inactive porous solid and a second liquid solvent. These two types of chromatography will be considered here in some detail.

Gas chromatography was the subject of an article in the *Battelle Technical Review* dated October, 1956. The June, 1953 issue included an article on ion exchange, which is considered a type of chromatography. Gas chromatography is largely an analytical tool, while ion exchange is used in producing many substances, from amino acids to rare earth metals.

Adsorption Chromatography

In this type of chromatography the solid, porous medium takes part in the actual separation process. Therefore, the preparation of the medium must be carried out with great care if uniform and reproducible results are to be achieved.

Materials used for the medium have included alumina, charcoal, clay, diatomaceous earth, silica, sugar, starch, and even powdered animal hide. The selected solid is usually packed into a tube or column, and the mixture to be separated is introduced at the top of the column packing. As the solvent percolates down through the column, repeated distributions of the dissolved mixture between the solid medium and the liquid solvent take place.

The substances to be separated are actually adsorbed on the surface of the solid column packing. The relative ease with which the various adsorbed substances can be washed off, or eluted from the solid column packing, determines the degree of separation. The adsorption and elution process occurs repeatedly as the substances pass through the packed column. (See previous page)

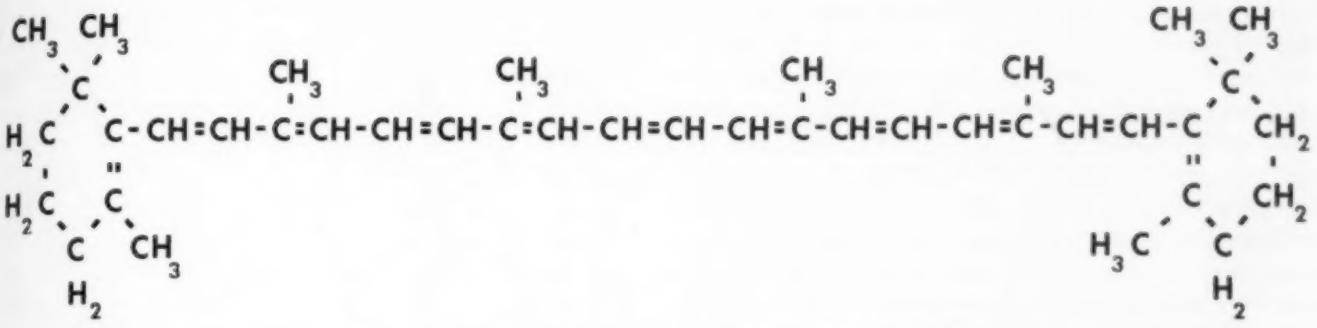
With the proper choice of column packing and solvent, the components of the mixture separate into zones, or bands. In some cases the bands are washed, or eluted through the entire length of the column. Then the portions of solvent containing the individual bands, representing separated mixture components, are collected separately. In other cases, the column packing containing the separated substances is pushed out of the column and cut so that each section contains one component of the original mixture. The individual sections are then washed with a suitable solvent to recover the various components.

The location on the column of the separated materials may be accomplished in various ways. In the separation of colored materials, such as dyes or pigments, location of the bands is a simple matter of visual inspection. When colorless substances are involved, locating the separated bands requires other techniques. If the mixture components will fluoresce in ultraviolet light, the bands are easily distinguished by this means. Spraying or streaking the extruded column packing with a suitable reagent to form colored derivatives of the separated compounds is another effective technique. In the separation of a mixture of radioactive materials, the bands are identified by means of a radiation detection device.

When the mixture components are passed entirely through the column, they may be identified in the effluent by ultraviolet fluorescence or by color formation after reaction with a suitable reagent. Measurement of some property of the effluent, such as its refractive index, specific gravity, or acidity can be used in determining which effluent fractions contain compounds of the original mixture. A device to measure the dielectric constant of the effluent can be connected to telephone equipment so that changes in effluent composition can be "heard". The effluent fractions may be evaluated also by testing their biological activity in plants or in living creatures, either microorganisms or experimental animals. Even such characteristics as odor and taste may be sufficiently pronounced to serve in distinguishing the separated components in the column effluent fractions.

Adsorption chromatography was the first type of chromatography to be applied to the separation of mixtures. It has often succeeded where all other means of separation have failed. However, it is empirical in

In recent studies, Dr. Fulmer has been responsible for the formulation of compounds for evaluation in connection with cancer chemotherapy research. In other studies, he has separated and examined the hydroxy acids from paper-mill waste liquor and the constituent acids of rosin. The author has also developed a chemical process for preparing a soluble starch product and has investigated the mechanism for color formation and methods for increasing the yield of a coloring agent derived from natural sources. Before joining Battelle, the author participated in the development of antibiotic and vitamin products at Lederle Laboratories.



1. *β-carotene contains eleven carbon to carbon double bonds and may exist in as many as 20 cis-trans combinations. Through the use of chromatographic methods the substance has been separated into as many as a dozen of its possible isomers.*

nature. Complete recovery of the applied materials from the column is seldom achieved.

Isolation of vitamin K_1 from crude material containing as little as 0.001 per cent of the vitamin has been accomplished using adsorption chromatography. In the analysis of urine, a component present in as low a concentration as one part in 100 million is concentrated by adsorption chromatography. The quantitative limits of this method of separation are bounded on the lower side by the sensitivity of the detection method for the substances being separated. The upper working limit is determined by practical limitations on the size of the apparatus to be used. Any considerable increase in the size of the apparatus is apt to be very expensive, and problems in its preparation and use become formidable. The range of sizes of samples usually applied to adsorption columns extends from a few milligrams in weight up to several grams. Larger scale chromatography has been used in separating and purifying vitamins, plant pigments, and antibiotics.

Separation of Optical and Cis-Trans Isomers

Adsorption column chromatography has been used in the separation of such closely related pairs of molecules as optical isomers and cis-trans isomers. Optical isomers have identical chemical composition and bonding, and differ only in spatial configuration, while cis-trans isomers differ only in geometric configuration.

The optical isomers may be separated by passage through a column packed with an optically active solid adsorbent. Optically active forms of lactose and of quartz have been used as column packings. The optical isomers may be reacted with an optically active substance such as the alkoloid brucine. The resulting derivatives may be separated, in some cases, by using conventional adsorbent packings such as charcoal or alumina. Separation, or resolution of "Tröger's base", (Figure 2), into its optically active components was done by repeated passage through a lactose column.

An example of cis-trans isomers is given by the two forms of stilbene, a substance useful in the preparation of dyes (Figure 3). The isomers are easily separated by passage through an alumina column. Molecules with a larger number of double bonds present further opportunities for cis-trans isomerism. Thus, a substance known as β-carotene (Figure 1) containing 11 carbon-to-carbon double bonds, is regarded as able to exist in as many as 20 cis-trans forms. Actually, the existence of definite, individual forms was in doubt until their separation was accomplished by chromatographic methods, yielding as many as a dozen isomers.

Adsorption chromatography has been used in the separation and study of bile pigments, carotenoids, synthetic dyestuffs, natural pigments, natural fatty acids, sugars, and amino acids. Hormones, carcinogenic compounds, natural toxins and poisons, the active principal of marihuana, alkaloids, vitamins, antibiotics, enzymes, and allergens have also been investigated by this technique. Applied to food technology, adsorption chromatography has been used for the detection of artificial dyes, the investigation of the components of black and green teas, and the study of wine. Drugs, insecticides, and petroleum products have been analyzed and studied by the same means.

Partition Chromatography

In partition chromatography, separation of substances depends on their relative tendencies to pass into one or the other of the solvents used. One solvent is held on an inert porous medium while the other solvent flows through the medium. The solvents must be relatively insoluble in each other to preserve, in essence, a two-phase liquid system. The porous medium should be able to hold a substantial quantity of one of the solvents, and should not act as an ordinary adsorbent for any component of the mixture to be separated. In partition chromatography the dissolved mixture is subjected to repeated extractive separation steps as the mobile solvent flows past the solvent held on the porous medium.

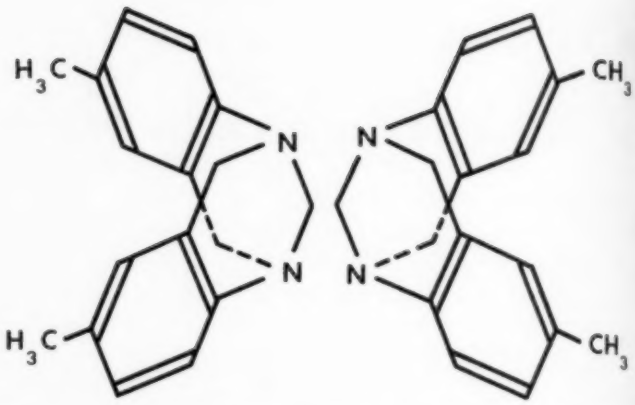
The ratio in which a dissolved substance is distributed between two solvents is known as the partition coefficient. When this partition coefficient, or solubility ratio, is high, it means that the dissolved substance will concentrate in the favored solvent in a relatively few extractions. This means that passage through a relatively short length of the packed column will achieve separation of this particular substance from other substances with low partition coefficients, or inverse solubility ratios in the solvents used. Solvent pairs chosen to show widely differing partition coefficients toward the various components of a mixture aid greatly in their separation.

Differences in tendencies to go into the mobile and the stationary solvents cause a holding back of solutes having a greater affinity for the stationary solvent. Solutes having a greater affinity for the mobile solvent tend to move with it through the column. The mixture components tend to separate into zones, or bands, which move at different rates in the direction of the solvent flow. The porous medium may be packed into a column, or it may be self-supporting, as in the case of paper chromatography. A glass strip coated by a thin layer of absorbent, called a "chromatostrip", has been used for partition chromatography. Another variation is the "chromatobar", a column of porous medium formed around a glass rod for support. These last two devices are used with an upward flow of solvent, and have the advantage of easy accessibility for spot testing or spraying of identification reagents.

Column Partition Chromatography

Materials used as column packing include silica gel, cellulose powder, starch, diatomaceous earth, and powdered glass. The column packing is often of a type that holds the more polar, or water-soluble of the solvents used. A column packing of a material such as powdered rubber or silicone-treated diatomaceous earth will hold the relatively nonpolar, or water-insoluble solvent.

Methods of recovery of separated materials from the partition column are similar to the procedures described for adsorption columns. Quite often the separated materials are passed entirely through the partition column and recovered from the effluent. Automatic devices are used to collect the effluent fractions. The fractions may be collected on a basis of weight, volume, time interval, or number of drops. Column-partition chromatography can separate materials down to their limits of detectability. As little as one-tenth milligram quantities of amino acids can be chromatogrammed to give recoveries accurate to within 3 to 5 per cent. A powdered cellulose column



2. *The organic compound Tröger's base presents an example of optical isomers that can be separated by chromatographic methods. Though the two forms differ as an object to its mirror image, they are chemically identical.*

has been used in the separation of uranium from low-grade ores preparatory to analysis and in the separation of gold from metal mixtures. Other examples of materials separated by column partition chromatography include protein derivatives, organic acids, aromatic acids, alcohols, natural pigments, antibiotics, including penicillin and its salts, caffeine, gamma-globulin fractions, sugars, and sugar derivatives. A column of powdered rubber has been used in the reversed-phase separation of fatty acids, the stationary liquid phase being the nonpolar solvent, benzene.

Plant growth-regulatory substances have been separated from diseased and healthy rose-leaf tissue by passage through a silica gel column. The amounts of growth substances recovered are much too small to be detected by conventional analytical techniques. Therefore, the biological activity in fractions of the column effluent is tested by determining its effect on the subsequent growth of first internode sections of germinated oat seedlings. From the results obtained from this work it is hoped to learn what changes occur in levels of growth substances in diseased rose leaves that might be associated with premature leaf drop.

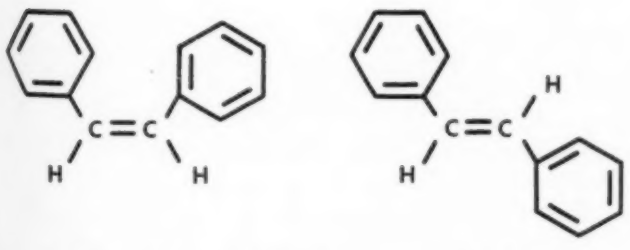
Paper Chromatography

In paper chromatography, the porous medium is paper, treated paper, or strips or sheets of other materials such as glass fibers. The mobile solvent flows over the paper, driven by capillary forces, like liquid flowing in a wick. The procedure is carried out in a closed container of some sort to prevent excessive evaporation of solvent. The paper may be used as a strip or sheet held vertically, while the mobile solvent flows downward, its movement aided by gravity. This is known as descending development. The mobile

solvent flows upward, against gravity, in ascending development. Two-dimensional paper chromatograms are made by turning the developed paper sheet through 90° and developing a second time. Usually, the second developing solvent differs from the first. This technique can give more marked separation of the components of a mixture than development in one direction with one solvent. A horizontal paper may be used, with solvent flowing radially outward from the center, as in the "disk" technique.

The developing of the paper chromatogram in its closed container may be hastened by warming in an oven, or in the case of the "disk" technique, applying centrifugal force. In the latter case, the paper disk is placed on a horizontal turntable and rotated at high speed as the mobile solvent is added at the center of the disk. The paper sheet may be rolled into a cylinder for use. Also a rectangular stack may be made by folding a long strip back and forth and pressing the pleated "accordion" strip into a solid pile, or a stack of filter paper disks pressed together makes a column without walls, called a "chromatopile". Long strips stacked up like a pack of cards and clamped together make a rectangular "chromatopack".

A developed paper chromatogram is commonly treated with a special reagent by dipping, spraying, or streaking to reveal the separated materials. Reagent solutions for the detection of amino acids are available in pressurized spray cans. The developed paper strip, roll, pile, sheet, or disk may be streaked with reagent to locate the zones containing the separated components of the mixture. The medium is then appropriately cut up and the sections washed with a suitable solvent to recover the individual components. Paper chromatography can be done with relatively simple apparatus, and usually little time is required in actual manipulation. Most of the procedure can take place unattended. Closely related materials can be separated. The method is widely applicable, and in qualitative work the separations are not very sensitive to changes in temperature. The results are highly reproducible, and very small amounts of material can be utilized. However, paper strip chromatography is limited primarily to analytical applications.



3. *Stilbene, which is useful in the preparation of dyes, is an example of cis-(left) and trans-(right) isomers separable by chromatography. The rigid double bond between the carbon atoms prevents rotation that would make the molecules identical.*

Paper chromatography can be used in certain cases to give valuable information about chemical structure. The members of a homologous series show a regular sequence in their behavior. When a number of similar type compounds have been studied, the data can be used to predict the paper chromatographic behavior of other compounds of that same type.

The same technique can be used also in the quantitative estimation of the components of a mixture. The separated substances may be measured on the paper for some property such as radioactivity. Treatment with an appropriate reagent may give a colored spot or zone which can be measured as to area or color intensity. The paper may be cut to isolate the various zones. Each cut section can be used in the microchemical determination of its content.

Paper chromatography is used for identification in conjunction with other tests. It is used in clinical medicine in the studies of samples of urine and blood. Amino acids in biological fluids, protein degradation products, sugars, alcohols, fatty acids, phenols, and aromatic acids have been separated through the use of paper chromatography. This method has been applied to the separation of metal compounds. Gold may be separated from the platinum metals, and uranium may be separated from associated impurities prior to determination. Preliminary separation steps may be needed in some cases due to mutual interferences of the metals.

Conclusion

Chromatographic techniques have contributed extensively to the advancement of the chemical and biochemical sciences. Research is improving the effectiveness of chromatographic methods to meet more difficult separation problems that may arise. Already a useful tool in the biochemical aspects of mental disease, cancer, heart and other diseases, it will be of increasing value as the studies continute.

In another area, chromatography also holds great promise. As indicated earlier, the use of chromatographic techniques for large-scale separations is seldom economically feasible, at present. However, the ability of the method to handle difficult separation problems suggests that efforts to adapt chromatography to commercial processes will continue. Thus, in the future, such separation processes may be increasingly important in the preparation of biological, medicinal, and other products.

NEW HIGH IN CHROMIUM PURITY

The glittering, jewel-like staff is actually a crystal bar of the purest chromium (99.99+) now available. Inspecting the bar, prepared by a process utilizing the thermal decomposition of chromium iodide, is Battelle's Dr. John M. Blocher, Jr. who guided development of the process. He states that the metal will enhance the fabricability and ingot yield of present wrought commercial chromium-containing alloys. Its properties are expected also to be useful in obtaining the ductile chromium-based alloys sought for space-age technology. Now under development at Battelle for the Chromalloy Corporation, the process was originated through research in cooperation with the Chilean Nitrate Sales Corporation. Contributions to the development and improvement of the process for preparing the metal have also been made by Neil D. Veigel, Joseph H. Oxley, and Thomas E. Cook.

NOTES from BATTELLE

ELECTRONIC RELIABILITY CENTER

The operation of an Electronic Component Reliability Center, established several months ago at Battelle, has just been announced by C. Robert Deeter, project director. This unique research and information center, supported by 11 of the nation's largest users and manufacturers of electronic components, is pooling reliability data generated by the participating firms and is conducting research toward improved reliability techniques.

The new facility provides two basic services to the participating firms. First, the Center issues reports on individual electronic part types, based on an engineering and statistical analysis of the pooled reliability and performance data. These reports contain procurement and application information useful in reliable electronic-system design. Second, reports are issued on research leading to new techniques for improving the reliability programs of the participating firms. During the first year, the Center staff is studying techniques for screening incoming component parts in such a manner as to predict the probability of future failure.

Explaining the purpose of the ECRC, Deeter said that many firms are accumulating large amounts of reliability and performance data as a result of the exacting requirements for reliability in missiles, space vehicles, supersonic aircraft, and electronic computers. In its contacts with industrial concerns, Battelle's Reliability Engineering Division recognized a growing need for a coordinated effort to avoid duplication and to fill gaps in the over-all reliability efforts of the country. These observations led to the formation of an industry group effort based on the efficient collection and combination of raw reliability data for analysis. The design conclusions thus derived should have a considerably higher degree of validity than is possible by using any of the individual inputs. The reports will be disseminated in a form suitable for many applications. Cooperation among the industrial firms in the group effort will (1) make possible the elimination of much duplication, (2) permit a guided program to fill gaps in reliability information, and (3) decrease the time and cost of obtaining the necessary reliability data on new types of parts or new environments.

Firms now participating in the Reliability Center program include Bell Telephone Laboratories, Boeing Airplane Company, International Business Machines Corporation, Lockheed Aircraft Corporation, The Martin Company, Motorola, Inc., Northrop Corporation, Radio Corporation of America, and Raytheon Company. Each firm contributes an equal share toward the cost of the Center's operation and each cooperates in making raw data available and in guiding the nature of the effort. In return, each participant receives the reports issued by the Center.

An invitation to cooperate in the Reliability Center program has been extended to a number of other industrial firms, Deeter said, because it is believed that the usefulness of the effort will be proportional to the number of participating firms, up to a manageable maximum.

FUTURE FOR REFRACTORY METALS

The refractory metals, those with melting points of about 3400 F or higher, are currently the subject of intensive research and development. As metallurgist Robert I. Jaffee pointed out last month in his paper before the High Temperature Symposium at Asilomar, California, those metals have emerged from their electronic and lamp industry beginnings and are now being accepted as materials of construction for advanced aircraft missile systems.

In appraising the future of these metals, Jaffee lists the following developments, which he believes have an excellent chance of taking place:

- Discovery of more sources of tantalum and rhenium throughout the world to satisfy the increasing demand for these metals.
- Increase in the capacity of electron-beam melting facilities until they equal sintering and arc-melting in importance for consolidating refractory metals.
- Continued advance in the use of powder-metallurgy molybdenum in large forgings and development of powder-metallurgy dispersion alloys to compete with arc-cast alloys in high-temperature structural applications.
- Production of tungsten sheet products of large size and useful ductility and the development of dispersion tungsten alloy sheet with significantly lower transition temperatures.
- Development of a substitute for alloying with rhenium to improve the breakdown fabrication of cast molybdenum and tungsten and the discovery of

alternatives to rhenium to improve low-temperature ductility.

- Production of refractory metals, in sheet sizes, of quality suitable for the aircraft industry, with inert atmosphere fabrication as a key factor in the achievement.
- Development of chromium sheet products with reasonable, though not good, low-temperature ductility.
- Development of tantalum-base alloys with high-temperature strength in line with the potential of its high-melting point.
- Development of oxidation-resistant columbium-base alloys, which, without protection, will meet missile and aircraft leading-edge requirements.
- Development of oxidation-protection systems for the refractory metals to eliminate oxidation failures in most applications, coatings having self-healing features to reduce the need for coating integrity.

* COLD EXTRUSION OF TITANIUM

Though cold extrusion is widely used in the forming of steel and certain other metals, the process has been applied little, if at all, in the production of titanium products. Titanium extrusion has probably been retarded most by the inability to achieve a satisfactory surface finish.

In one phase of a recent research project for the Manufacturing Methods Branch of the Air Material Command's Aeronautical Systems Center, Battelle technologists developed a surface treatment that produced excellent results in wire and tube drawing of titanium and in reciprocating and rotary wear tests. As reported by Alvin M. Sabroff and Paul D. Frost of the Institute's light metals division, the treatment consists of immersion of the metal in a fluoride-phosphate bath at room temperature. The adherent, continuous coating that results serves as a lubricant retainer. Reduction in extrusion pressure and production of a good surface finish depends upon selection of an effective lubricant.

During the study, many types of lubricants were evaluated—graphite, molybdenum disulfide, boron nitride, wax, soaps, polyalkylene glycol, and sulfochlorinated mineral oil. Solid-film lubricants produced the best surface finishes. Most effective of all were self-drying gum-resin mixtures containing either 10 per cent graphite or 5 per cent graphite and 5 per cent molybdenum disulfide. With the combination of coating and lubricants, hollow shapes of unalloyed titanium, with surface finishes of 30 to 60 microinches, were cold extruded at pressures comparable to those used for extruding similar steel shapes.

Current research on the same project will include a producibility study on selected aircraft parts to be made from titanium or titanium alloys. This research is expected to advance the application of cold extrusion in the active production of titanium parts.

* Electropolishing plus leveling zinc plating provides an excellent method for finishing zinc die castings—probably more economical and giving better protection than current buffing and cleaning methods. This is the report of W. H. Safranek, H. R. Miller, and C. L. Faust of Battelle's Electrochemical Engineering Division. According to information from die casting companies, buffing costs vary from 4 to 29 cents per square foot, depending on the shape of the piece, while electropolishing and leveling zinc plating costs are estimated at 6 to 10 cents per square foot. Accelerated-corrosion and outdoor-weathering evaluations showed the method also improved the corrosion resistance of copper, nickel, and chromium-plated zinc die castings. The research on electropolishing and leveling zinc plating was one of several phases of the work being conducted for the American Zinc Institute on new finishes for zinc die castings.

* Battelle staff members recently named to technical posts include: *F. W. Boulger,* member, Panel on Machining, Committee on Development of Manufacturing Processes for Aircraft Materials, Materials Advisory Board, National Academy of Sciences—National Research Council; *R. B. Engdahl,* member, Board on Technology, American Society of Mechanical Engineers and ASME national representative to the American Association for the Advancement of Science; *H. B. Goodwin,* member, Metallurgical Documentation Committee, American Society for Metals; *J. L. Gray,* member, Patent Law Committee, Ohio State Bar Association; *R. I. Jaffee,* member, Advisory Committee for the Refractory Metals Sheet Rolling Program, Materials Advisory Board, NAS—NRC; *P. J. Rieppel,* member, Subcommittee on Weld-Metal Properties, Welding Research Council; *O. A. Ullrich,* member, Task Group on Formulation of Terms and Definitions Involving Electrostatic Patterns, American Institute of Electrical Engineer—Institute of Radio Engineers Subcommittee on Dielectric Devices.

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TECHNICAL
REVIEW

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12419 Lockheed X-17 Rocket Test Vehicle and Its Applications. Details of design and performance; description of telemetering equipment. No guidance equipment is carried; the X-17 depends upon aero-dynamic stabilization for correct orientation, both during the ascent and in the re-entry phase. The resulting oscillations and dispersion are analyzed in considerable detail, and results of the analysis are summarized. ***Ronald Smelt.*** *ARS Journal*, v. 29, Aug. 1959, p. 565-572.

12420 The Emissivity and Absorptivity of Parachute Fabrics. Describes equipment which was used to measure the absorptivity for solar radiation and the long-wave-length emissivity for parachute materials, and reports these data for a number of important parachute materials. ***J. P. Hartnett, E. R. G. Eckert, and R. Birkebak.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 81, no. 3, Aug. 1959, p. 195-201.

12421 A Quantitative Analysis of the Characteristics and Limitations of Aerodynamic Flight Within the Atmosphere. I. Characteristics. Analysis of practical limits of aerodynamic flight within the atmosphere. The cruising and aerospace vehicle flight regime are defined and analyzed. Fundamental equations relating to these limits are derived. ***William Chester Walter.*** *Aero/Space Engineering*, v. 18, Aug. 1959, p. 43 + 4 pages.

12422 Secondary Power in Advanced Flight Vehicles. Stresses the importance of secondary power in any future national program directed toward new aeronautical frontiers—that is, military vehicles operating up to the fringes of the atmosphere and national exploratory missions beyond the atmosphere from which may evolve future military vehicles. ***Kelso Jones.*** *Aero/Space Engineering*, v. 18, Aug. 1959, p. 54 + 4 pages.

12423* New Concepts in Airport Design. Schemes to match the airport to the plane. The new Dulles International Airport will begin to serve Washington early in 1961. *American Engineer*, v. 29, Aug. 1959, p. 27 + 3 pages.

12424 An Economic Study of the Military Airframe Industry. Development of the industry and airframe; characteristics of the military airframe industry; economic factors. ***Miguel Angel Reguero.*** 272 pp. 1957. Available from Program Evaluation Office, Directorate of Procurement and Production, Wright-Patterson Air Force Base, Ohio. (TL724 R26e)

12425 For Space Vehicles—Improved Silicon Photovoltaic Cells. Silicon photovoltaic cells are being used in satellites as power sources. They are low in weight, have a good conversion efficiency, and can withstand environmental stresses. A new process that makes this possible is described. ***Harry Nash and Werner Luft.*** *Electronic Industries*, v. 18, Aug. 1959, p. 91 + 5 pages.

12426 Operational Flight Testing of Early Instrument Landing Systems. The development of successful instrument approach and landing involved the solution of not only technical problems, but operational problems as well. A review of methods used to overcome operational problems is made, covering the period from the earliest successful instrument landing to the introduction of instrument approach into routine scheduled operation. ***E. A. Cutrell.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 2, June 1959, p. 67-70. (TK1 In6.6a Vis.)

12427 Ground-Controlled Approach—Its Development and Early Operational Use. ***Chester Porterfield.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 2, June 1959, p. 71-75. (TK1 In6.6a Vis.)

12428 A Survey of Instrument Approach Systems in the United States. ***Henry I. Metz.*** *IRE Transactions on Aeronautical and Navigational Electronics*, v. ANE-6, no. 2, June 1959, p. 78-84. (TK1 In6.6a Vis.)

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*Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

12429 Improvements on the Instrument Landing System. Deals primarily with CAA contribution to the art of instrument landing systems and is confined to the localizer and glide-path portions of the system. Describes briefly the present standard 8-loop localizer used at most sites as well as some modifications made in the basic localizer concept in order to adapt it to locations where siting problems exist. It also describes the standard glide slope as well as a new type of glide slope for use at extremely poor locations. ***W. E. Jackson.*** *IRE Transactions on Aeronautical and Navigational Electronics,* v. ANE-6, no. 2, June 1959, p. 85-94.

12430 Investigation of National Defense Missiles. Hearings Before the Committee on Armed Services, House of Representatives, Eighty-Fifth Congress, Second Session, Pursuant to H. Res. 67. No. 71. p. 3973-4924. 1958. U. S. Government Printing Office, Washington, D. C. (UG630 Un3.231i)

12431 Aerodynamics of Wings and Bodies at Transonic Speeds. Basic concepts and principal results from numerous experimental and theoretical investigations of transonic flow past thin wings and slender bodies. Emphasis is placed on the correlation and evaluation of results provided by diverse methods for the approximate solution of the nonlinear equations of the small disturbance theory of transonic flow. ***John R. Spreiter.*** *Journal of the Aero/Space Sciences,* v. 26, Aug. 1959, p. 465-486.

12432 An Experimental Study of the Flow Field About Swept and Delta Wings With Sharp Leading Edges. It was found that near the root section of either type of wing the flow is conical. The edge of the vortex sheet which originates at the leading edge is a straight line whose position relative to the leading edge depends only on incidence. On swept wings, the vortex edge turns downstream as soon as the vortex sheet covers the front half of the wing chord, and the flow under the vortex sheet outboard of that turning point is uniform and parallel to the leading edge of the wing. On narrow delta wings, the conical symmetry persists almost to the trailing edge. ***Ivan Jaszlics and Leon Trilling.*** *Journal of the Aero/Space Sciences,* v. 26, Aug. 1959, p. 487 + 8 pages.

12433 Divergence of Plate Airfoils of Low Aspect Ratio at Supersonic Speeds. Theoretical investigation of low aspect ratio rectangular plate wings of constant thickness. The form of the chordwise distortion is deduced from the differential equation representing the state of neutral equilibrium for small displacements at the critical divergence speed. Problems are investigated using measured structural flexibility coefficients together with theoretical aerodynamic coefficients. A series solution based on the Rayleigh-Ritz approach is discussed. ***G. J. Hancock.*** *Journal of the Aero/Space Sciences,* v. 26, Aug. 1959, p. 495 + 13 pages.

12434* Cast Magnesium Structures in Reentry Vehicles. Use of magnesium in substructures of atmosphere reentry vehicles. ***J. W. Jakubowski.*** *Missile Design & Development,* v. 5, Aug. 1959, p. 32-34.

12435 Short Notes Contributed to the Pressure Measurements Meeting, Sponsored by the AGARD Wind Tunnel and Model Testing Panel. Collection of 31 papers, dealing with various aspects of pressure measurement, contributed by authors from various NATO countries. *North Atlantic Treaty Organization, AGARD Report No.* 163, Mar. 1958, 203 pp. (TL565 Ag11r Vis.)

12436 Observations of the Russian Satellites and the Structure of the Outer Terrestrial Atmosphere. A new direction-finder, 20 MHz, which was developed by Telefunken in Ulm is described. The instrument uses three pairs of adcock-antennas. The direction of the wave front and amplitude of received signals can be measured at the front of a television tube. A movie-camera registers pictures with a time resolution of 0·1 sec. The accuracy of the measured azimuths is about 0·5°. For 1957 α_1, 1957 β and 1958 δ, optical observations of the German Moonwatch-groups were used. Further orbit data were obtained from the Moonwatch Headquarters. ***H. K. Paetzold.*** *Planetary and Space Science,* v. 1, no. 2, Apr. 1959, p. 115-124.

12437 The Potential Theory of Unsteady Supersonic Flow. Linearized equations; transformation of subsonic and supersonic wing equations; reduction to steady flow; two-dimensional problems; simple planforms; rectangular and the quadrilateral wings; slender wing methods; delta wing; low aspect ratio rectangular wing; slender non-planar bodies; non-linear problems. ***John W. Miles.*** 220 pp. 1959. Cambridge University Press, London. (TL573 M59p)

12438 Acoustical Testing at Northrop Aircraft. Malfunction or failure of airborne structures and equipment due to acoustical excitation has become a major design problem. Describes a pulse-jet facility capable of producing a sound pressure of 150 decibels. ***D. C. Skilling.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959. p. 121-126. (TG265 So13p Vis.)

12439* Vertical Vibrations of Helicopter Rotor Blades. A simple method for studying rotor blade vibration in a vertical plane is presented, which may be applied both to hinged and to cantilever blades. ***Al. Marinescu.*** *Revue de Mécanique Appliquée,* v. 4, no. 1, 1959, p. 19-27.

12440* Prime Missile Headache: Clean Stage Separation. A number of missile and spacecraft aborts can be traced to the failure of the stage separation system. Discusses why the separation problem is so tough to lick. ***Kurt R. Stehling.*** *Space/Aeronautics,* v. 32, no. 2, Aug. 1959, p. 42-46.

12441* Acoustic Fatigue: Key Element in High Mach Design. Turbojet engines have introduced a new factor that must be considered in designing high Mach Structures: fatigue due to the intense sound pressures generated by engine exhaust flow. This effect can be so critical as to be a major consideration in choosing the engine locations. ***Gordon L. Getline.*** *Space/Aeronautics,* v. 32, no. 2, Aug. 1959, p. 54-56.

12442* Manned Space Station Needs Special "Ferries and Tugs". Use of an orbital navigation computer and manipulator control by scale models. ***S. B. Kramer and R. A. Byers.*** *Space/Aeronautics,* v. 32, no. 2, Aug. 1959, p. 61-63.

12443 Projection Display System for the Development Model of the An/TSQ-13. Describes system which presents an expanded view of the air situation at an air control center. ***Hugh J. Sweeney and Wyatt R. Fox.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-59-107,* Feb. 1959, 38 pp. (TK7800 Un3.12b Contin.)

12444 The Determination of Aircraft Stability Coefficients From Flight Test Data. I. Theoretical Considerations. II. Longitudinal Investigations. Discusses three general problems associated with the extraction of stability coefficients from flight-test data involving large-amplitude motions. They are the determination of an adequate mathematical model of the dynamic system, the selection of the appropriate technique for the extraction of the coefficients, and a knowledge of the exact number of unknown coefficients which can be theoretically determined from any given response. ***Lloyd E. Wilkie, et al.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 57-410, Apr. 1958, 142 and 131 pp. (TL507 Un3.18t Contin.)

12445 1958 NASA/USAF Space Probes (ABLE-1) Final Report. I. Summary. The three lunar probes of August 17, October 13, and November 8, 1958 are described. Details of the program, vehicles, payloads, firings, tracking, and results are presented. Principal result was the first experimental verification of a confined radiation zone of the type postulated by Van Allen and others. *U. S. National Aeronautics and Space Administration, NASA Memorandum* 5-25-59W, June 1959, 84 pp. (TL782 Un3rm Vis.)

12446* 10-Year "Shopping List" Pegs Materials, Manufacturing Needs of Aerospace Industry. Metals requirements are tabulated. ***Nat Wood.*** *Western Metalworking,* v. 17, Aug. 1959, p. 27-31.

12447* Forebodies of Revolution With a Low Wave Drag in the Transonic and Higher Supersonic Ranges. Forebodies of revolution with minimum wave drag (Sears-Haack bodies) are calculated in a first approximation, i. e., for very slender bodies, from related pointed half-bodies of revolution with

distributions of cross-sectional areas which can be expressed as polynomials in the axial coordinate. A comparison of the wave drag of the two Sears-Haack bodies in the range at low and at higher supersonic speeds shows a decrease in drag coefficients with increasing Mach number. (*In German.*) Nichtangestellte Rotationshalbkörper mit kleinem Wellenwiderstand im schallnahen und höheren Überschallgebiet. ***Werner Schmidt.*** *Zeitschrift für Flugwissenschaften*, v. 7, July 1959, p. 194-201.

See also: **12925** (ablation of re-entry body); **12998** (jet and rocket propulsion units); **13388** (aircraft reactor experiment).

AGRICULTURE

12448* Multiplication of Polyhedral Virus in Insect Tissue Cultures. In hanging drop cultures of connective-tissue cells of ovarian tubules and cells of cyst walls of testes of *Bombyx mori* and *Antheraea pernyi*, a rapid multiplication of the corresponding polyhedral viruses takes place after artificial infection. The viruses can also infect the male germ cells, but only when they are freely dissociated in the culture. (*In Ukrainian.*) Rozmnozhennia poliedrenogo virusu v kup'turakh tkanin komakh. ***Natalia B. Medvedeva.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi*, 1959, no. 7, p. 790-794.

12449* Heat Conduction and Temperature Profiles in Air and Soil. A review. ***C. H. B. Priestley.*** *Australian Institute of Agricultural Science, Journal*, v. 25, no. 2, June 1959, p. 94-107.

12450* Seed Protein Sources—Amino Acid Composition and Total Protein Content of Various Plant Seeds. An extensive literature survey on seed proteins has been made, with attention given to both amino acid composition of various seed proteins and the total quantity of protein produced by the seeds. Data have been grouped according to botanical classifications and correlations drawn where possible. The various plant families have been rated according to their potentialities as protein-producing seed crops in the U. S. ***C. R. Smith, Jr., M. C. Shekleton, I. A. Wolff, and Quentin Jones.*** *Economic Botany*, v. 13, Apr.-June 1959, p. 132-150.

12451 Infrared Aerial Photography in Agriculture. For many uses, this new technique is unsurpassed as a tool for immediate and long-range planning in agriculture. ***Steven Charter.*** *Journal of Agricultural and Food Chemistry*, v. 7, Aug. 1959, p. 536-539.

12452 Progress in Liquid Pesticide Formulations. ***Edgar Selz and Paul Lindner.*** *Journal of Agricultural and Food Chemistry*, v. 7, Aug. 1959, p. 540-543.

12453 Fractionation of Sorghum Grain Wax. Sorghum wax differs from carnauba wax in having a relatively smaller proportion of esters and a larger proportion of alcohols. ***J. L. Dalton and H. L. Mitchell.*** *Journal of Agricultural and Food Chemistry*, v. 7, Aug. 1959, p. 570-573.

12454* The Effects of Field Applications of Some of the Newer Pesticides on Honey Bees. Residues of 0.25 lb. actual dieldrin per 100 gallons of spray may be highly toxic to honey bees (*Apis mellifera* L.) for periods at least up to 96 hours after application. ***Frank R. Shaw.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 549-550.

12455* Natural Control of Florida Red Scale on Citrus in Florida by Predators and Parasites. Parasitic hymenoptera represent the critical factor in natural control. Eleven different parasitic wasps attack the scale in citrus groves. *Pseudhomalopoda prima* (Gir.), the parasite attacking mature female scales, is the critical parasite species. Absence from or reduction of the species in Florida red scale infestations invariably results in outbreak infestations. ***Martin H. Muma.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 577-586.

12456* Biological Control of *Saissetia nigra* (Nietn.) in California. In California during the first half of the present century, the nigra scale, a tropical insect, adapted itself to subtropical conditions and increased to very destructive numbers. In 1939, the upward trend was then drastically reversed by the action of the hymenopterous endoparasite *Metaphycus helvolus* (Comp.), which had been colonized on nigra scale infestations in 1938. Within a few years the nigra scale population in California had fallen to a completely noneconomic density. The continual action of *M. helvolus* populations produced on associated scale insects against the nigra scale tends toward the eradication of the nigra scale. ***Stanley E. Flanders.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 596-600.

12457* Toxicity of Several Insecticides to Two Species of Beneficial Insects on Cotton. Dieldrin was the least toxic material tested against the convergent lady beetle and toxaphene was the least toxic material tested against adult insidious flower bugs. ***Horace R. Burke.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 616-618.

12458* Synergistic Action of Piperonyl Butoxide With Bayer 21/199 and Its Corresponding Phosphate in Mice. The joint oral administration of piperonyl butoxide (1:5) increased the toxicity of both Bayer 21/199 and its corresponding phosphate to mice four- to six-fold. ***William E. Robbins, Theodore L. Hopkins, and Darrell I. Darrow.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 660-663.

12459* The Toxicity of Malathion to Killifish (Cyprinodontidae) in Delaware. According to the 4-hour results, 26.3% died and 31.2% were unaffected, whereas 42.4% were sublethally poisoned. ***Richard F. Darsie, Jr., and F. Eugene Corriden.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 696-700.

12460* Locale of Aged Tedion Residues on Citrus Fruits. Most residues of organic pesticides on citrus fruit quickly penetrate the waxy cuticle and enter the oily portions of the peel, where they are protected from the various chemical and physical forces of weathering and are generally inaccessible to the pest organism. About 90% of Tedion residues on oranges, however, remained within the waxy cuticle. About 60% of the residual Tedion on field-treated lemons is removed during commercial washing operations. ***R. C. Blinn, et al.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 723-724.

12461* The Relationship Between Insecticide-Altered Aphid Populations and the Spread of Potato Leaf Roll. Control of the spread of the leaf-roll virus disease by means of aphid control seems practical only under conditions of low-aphid infestation (less than 10 aphids per leaf). Under high-aphid infestations, insecticide application may not reduce leaf roll spread but it might be necessary to prevent direct damage to the plants from aphid feeding. In either case, control measures once begun must be continued until the aphid immigration has abated. ***E. C. Klostermeyer.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 727-730.

12462* Cross Resistance in a Diazinon-Resistant Strain of *Musca domestica* (L.). Laboratory selection of a Diazinon-resistant field strain of house fly, *Musca domestica* (L.), for nine generations on Diazinon-treated panels increased resistance not only to Diazinon but to a wide variety of insecticides. The levels of resistance to the various materials, as determined by topical application, were: Diazinon (38-fold), parathion (16), ronnel (18), Chlorthion, (23), malathion (5), Sevin, (more than 37-fold), Isolan, (14), Pyrolan, (10), chlordane (400), dieldrin (220), lindane (250), DDT (more than 6,400-fold), TDE (more than 1,300), methoxychlor (more than 3,600), Dilan, (10) allethrins (5), pyrethrins (4), and Lethane 384. These increases in tolerance, except to Lethane, pyrethrins, allethrins, and malathion (which may be simply instances of vigor tolerance), are considered true resistances. The extent of cross-resistance indicates that most of the contemporary materials will be ineffective against Diazinon-resistant flies. Tests on resistant flies collected from the field without further selection on Diazinon in the laboratory indicate that the pattern of resistance determined in this study is very similar to that which occurs under completely natural conditions of selection. ***Andrew J. Forgash and Elton J. Hansens.*** *Journal of Economic Entomology*, v. 52, no. 4, Aug. 1959, p. 733-739.

12463* Demeton Residues on Turnips, Squash, Tomatoes, Peppers and Snap Beans. The systemic pesticide demeton penetrates into the edible portions of vegetables in varying

degrees. Little, if any, toxicant was found to be translocated into developing turnip roots, squash, tomatoes, and peppers as a result of foliar applications. Turnip tops require at least 21 days' weathering and growth to reach tolerance levels. Snap beans require a 14-day interval to satisfy Federal requirements. ***C. H. Van Middelem and R. E. Waites.*** *Journal of Economic Entomology,* v. 52, no. 4, Aug. 1959, p. 741-744.

12464* "Brusone" Disease of Rice in Hungary. Primary cause of the disease is H_2S. This compound kills roots of rice plant. Occurrence of fungi (Piricularia, etc.) is merely a secondary phenomenon and is probably connected with disturbance of the N metabolism of the plant. Formation of H_2S and its toxic effect on the rice plant are promoted by several factors but especially by cool and sunless weather. In such weather the C assimilation of the paddy plant is reduced and the toxic H_2S in the soil is not transformed. ***R. Vámos.*** *Plant and Soil,* v. 11, no. 1, June 1959, p. 65-77.

12465* Agricultural Residues as Raw Materials for Viscose-Grade Pulp. Test values for pulps from wheat straw, corn stover fiber, and bagasse fiber compared favorably with those of six dissolving pulps produced commercially from both hard and softwoods. ***T. R. Naffziger, R. S. Matuszewski, G. H. Nelson, and T. F. Clark.*** *Tappi,* v. 42, July 1959, p. 609-612.

BIOCHEMISTRY AND BIOPHYSICS

12466 The Configuration of Ribonuclease at Low ρH in 2-Chloroethanol and in 2-Chloroethanol-Water Mixtures. The transition from native aqueous ribonuclease to the highly helical structure occurs in two stages, through an intermediate with about the same helix content as aqueous ribonuclease but with a high intrinsic viscosity and flexibility, which suggests that its non-helical portions are more or less randomly coiled. The highly helical structure in chloroethanol is presumably the result of intramolecular H bonding; the compact configuration in aqueous solution is ascribed primarily to hydrophobic forces. ***Robert E. Weber and Charles Tanford.*** *American Chemical Society, Journal,* v. 81, July 5, 1959, p. 3255-3260.

12467 Physical-Chemical Studies of Soluble Antigen-Antibody Complexes. X. The Reaction of a Univalent Protein Antigen With Antibody. Intrinsic bond strength is independent of the size of the antigen-antibody aggregate, at least for aggregates which are soluble. ***Frank A. Pepe and S. J. Singer.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3878-3887.

12468 Physical Chemical Studies of Soluble Antigen-Antibody Complexes. XI. An Analysis of the Resolution by Electrophoresis and Ultracentrifugation of a Univalent Antigen-Bivalent Antibody System. *S. J. Singer, Frank A. Pepe, and David Ilten.* *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3887-3891.

12469 The Biogenesis of Morphine. Radioactive morphine was obtained when DL-phenylalanine-2-C^{14} or DL-tyrosine-2-C^{14} was fed to *Papaver somniferum* plants. Systematic degradation of the morphine derived from the tyrosine yielded compounds whose activities were compatible with the hypothesis that morphine is formed from two molecules of tyrosine *via* norlaudanosine. ***Edward Leete.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3948-3951.

12470 Nitrogen Mustard Analogs of Antimalarial Drugs. The hydrochlorides of thirty N mustard derivatives in the quinoline and acridine series of antimalarial drugs have been synthesized for studies of their antitumor potentialities. Pamoates of several of the mustards have also been prepared. Some of the diol intermediates were made by independent syntheses. ***Richard M. Peck, Robert K. Preston, and Hugh J. Creech.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3984-3989.

12471 Coenzyme Q. VII. Isolation and Distribution of Coenzyme Q_{10} in Animal Tissues. The isolation of coenzyme Q_{10} from beef hearts has been confirmed and extended. Crystalline Q_{10} has been isolated from human hearts and beef striated muscle. Q_{10}, identified by spectra and R_f's, has also been found in the mouse carcass, in the kidney tissue of steers and lambs and in the heart tissue of swine, rats, chicks, turkeys and rabbits. ***Bruce O. Linn, et al.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4007-4010.

12472 Selective Cleavage of C-Tryptophyl Peptide Bonds in Proteins and Peptides. The application of the N-bromosuccinimide (NBS) cleavage to proteins under specified conditions releases new N-terminal residues. Bond cleavages generally average 20-40% and the number of new N-terminals formed corresponds to the number of tryptophans in the molecule. The results indicate the presence of Try-Lys and Try-Ala bonds in tobacco mosaic virus (TMV) protein, of a Try-Ala bond in the I-peptide from TMV protein, of a Try-Ala bond in human serum albumin, and of Try-Gly and Try-Ser bonds in bovine serum albumin. Lysozyme which contains seven tryptophans is cleaved by the reagent with much lower yields. ***L. K. Ramachandran and B. Witkop.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4028-4032.

12473 The Reversible Transformation of β-Lactoglobulin at pH 7.5. The specific optical rotation and the titration curve of β-lactoglobulin both indicate that a reversible change in the configuration of this protein occurs at 25° near ρH 7.5. A similar conclusion is reached from sedimentation data obtained by Pedersen in 1936. The configurational change parallels the titration of imidazole groups and is accompanied by the reversible release of two carboxyl groups from the interior of the molecule. The transition is a novel one in that no general unfolding of the molecule occurs: it must be regarded instead as a refolding of part of the polypeptide chains. ***Charles Tanford, Lyle G. Bunville, and Yasuhiko Nozaki.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4032-4036.

12474 Partition by Zone Ultracentrifugation of the Two Complement-Fixing Particles in the Foot-and-Mouth Disease Virus System. The sedimentation coefficient of the smaller complement-fixing (CF) particle of the foot-and-mouth disease virus system, type A, strain 119, in bovine-passed material was determined by assay of moving boundary fractions from a swinging bucket rotor to be $s_{20,w} = 14 \pm 1$ S. ***Rodes Trautman, Milton Savan, and Sydney S. Breese, Jr.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4040-4044.

12475* Chemistry of Polypeptides Syntheses of Peptides IV. The most recent state of research in this field is presented by several examples, and a review is offered of the advance of peptide synthesis during the last two years. (*In German.*) Aus der Chemie der Polypeptide Peptid-Synthesen. IV. ***Theodor Wieland.*** *Angewandte Chemie,* v. 71, no. 13, July 7, 1959, p. 417-425.

12476 Annual Review of Biochemistry. Contains reviews on chemistry of carbohydrates, the lipides, amino acids and peptides. Other papers discuss the structure of proteins, protein biosynthesis, and the metabolism of steroids. The biochemistry of carcinogenesis and of genetic factors; vitamins; mineral metabolism; and neurochemistry are other principal subjects. ***J. Murray Luck, Frank W. Allen, and Gordon Mackinney, editors.*** v. XXVIII. 698 pp. 1959. Annual Reviews, Inc., Palo Alto, Calif. (QP501 A78a Vis.)

12477 Manned Outposts in Space. By 1963, national space capability will require biotechnical satellite stations, like those described, as a transition between Project Mercury capsules and manned lunar and interplanetary spacecraft. ***Krafft Ehricke.*** *Astronautics,* v. 4, Aug. 1959, p. 20 + 4 pages.

12478* The Role of Endogenous Citrates in the Elimination of Polonium From the Organism. A correlation is established between the native citrate concentration and the radioactivity level in urine of the rabbits poisoned with Po. (*In Russian.*) Rol' endogennykh tsitratov pri vyvedenii poloniia iz organizma. ***A. P. Safronov.*** *Biokhimiia,* v. 24, no. 3, May-June 1959, p. 421-424.

12479* The Distribution of the Thalassemia Gene: A Historical Review. *Amoz I. Chernoff.* *Blood,* v. 14, Aug. 1959, p. 899-912.

12480* Chromosomal Alterations in Relation to Speciation. A review. ***Arun Kumar Sharma and Archana Sharma.*** *Botanical Review,* v. 25, no. 3, July-Sept. 1959, p. 514-544.

12481 Cancer: a Worldwide Menace. Some facts and figures on its occurrence in the United States and abroad. 40 pp. 1959. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (RC275 Un3.23c)

12482 A Reliable Frozen Tissue Bank: Viability and Stability of 82 Neoplastic and Normal Cell Types After Prolonged Storage at −78°C. ***Theodore S. Hauschka, J. T. Mitchell, and D. J. Niederpruem.*** *Cancer Research*, v. 19, no. 6, pt. 1, July 1959, p. 643-653 + 1 plate.

12483 Stimulation of Host Defense Against Experimental Cancer. II. Temporal and Reversal Studies of the Zymosan Effect. Low doses of zymosan stimulate host defenses against Sarcoma 180 in mice. A single dose of 150 mg/kg hydrocortisone acetate injected at various times after tumor implantation could completely block at 9 days, partially block at 13 days, and not affect at 2 days the tumor regression which normally occurs following zymosan therapy. ***William T. Bradner and Donald A. Clarke.*** *Cancer Research*, v. 19, no. 6, pt. 1, July 1959, p. 673-678.

12884 Vitamin B_{12} (Cobalamin). A review based chiefly on Russian literature. ***V. A. Trufanov.*** *Clinical Chemistry*, v. 5, no. 4, Aug. 1959, p. 335-348.

12485* Chromosomal Aberrations and Human Maladies. Polydysspondyly. Analysis of somatic cells of an infant with multiple abnormalities of the vertebral column showed 45 chromosomes. The authors suggest that a centromeric fusion of the small telocentric V_8 and the large telocentric T_1 may be responsible for this chromosome number. (*In French.*) Aberrations chromosomiques et maladies humaines. La polydysspondylie à 45 chromosomes. ***Raymond Turpin, Jérome Lejeune, Jacques Lafourcade, and Marthe Gautier.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 25, June 22, 1959, p. 3636-3638.

12486* Studies on Cellular Adhesion in Tissue Culture. I. The Effect of Serum. II. The Adhesion of Cells to Gel Surfaces. The adhesion of trypsinised cells to various gel surfaces is described. Adhesion of such cells requires the presence of some 5-10% of serum with the gels of Ca alginate, silica, and agar. The gels of fibrin and collagen do not require the presence of serum. Fibrin will also make silica and agar gels serum-independent. ***L. Weiss.*** *Experimental Cell Research*, v. 17, no. 3, June 1959, p. 499-515.

12487* A Factor in Normal Human Serum That Inhibits Epithelial Growth in Organ Cultures. ***L. M. Franks.*** *Experimental Cell Research*, v. 17, no. 3, June 1959, p. 579-581.

12488* The Mechanism of Radiation Protection by Histamine and Other Biological Amines. Concludes that histamine, epinephrine and a number of other biological amines protect against irradiation by reducing the O tension in the spleen and possibly in other blood forming organs. ***C. van der Meer and D. W. van Bekkum.*** *International Journal of Radiation Biology*, v. 1, no. 1, Jan. 1959, p. 5-23.

12489* On the Relative Role of Mutation and Recombination in Responses to Selection for Polygenic Traits in Irradiated Populations of *D. melanogaster*. X-ray treatments are a very efficient tool for inducing polygenic mutation and therefore additive genetic variability for polygenic traits in *Drosophila*. Artificial selection can make use of the new genetic variability. X-ray-induced increase in recombination rates does not seem to be an important factor in determining the observed effects, at least in the described experiments. ***R. E. Scossiroli and S. Scossiroli.*** *International Journal of Radiation Biology*, v. 1, no. 1, Jan. 1959, p. 61-69.

12490* A Biophysical Study of Phage DNA by Means of Molecular Autoradiography. ***S. Aurisicchio, G. Cortini, V. Emma, and F. Graziosi.*** *International Journal of Radiation Biology*, v. 1, no. 1, Jan. 1959, p. 86-90.

12491* The Effect of Colloidal ^{198}Au on the Bone Marrow and Its Replacement in Rabbits. It has been found that ^{198}Au will produce severe hypoplasia, or even complete aplasia, without causing acute radiation damage to other organs. Roughly half the ^{198}Au is taken up by the marrow and almost all the rest by the liver. The survival rate is increased after double transfusions of marrow. ***J. M. Garvan, E. P. George, F. A. Rocke, and S. Vince.*** *International Journal of Radiation Biology*, v. 1, no. 2, Apr. 1959, p. 153-169.

12492* The Viability of Near-Normal Irradiated Chromosomes. After the exclusion of major mutations, both lethals and semi-lethals, the viability in the *Drosophila* male of X-chromosomes irradiated in sperm shows a slight reduction, which is, nevertheless, highly significant. These results indicate mutations of very low magnitude and very high frequency. ***A. J. Bateman.*** *International Journal of Radiation Biology*, v. 1, no. 2, Apr. 1959, p. 170-180 .

12493* Physiologic, Biochemical, Immunologic and Pathologic Changes Following Ozone Exposure. ***Lester D. Scheel, et al.*** *Journal of Applied Physiology*, v. 14, no. 1, Jan. 1959, p. 67-80.

12494* Studies on the Antigenic Structure of Ribonuclease. I. General Role of Hydrogen and Disulfide Bonds. ***Ray K. Brown, Robert Delaney, Lawrence Levine, and Helen Van Vunakis.*** *Journal of Biological Chemistry*, v. 234, no. 8, Aug. 1959, p. 2043-2049.

12495* Nuclear-Cytoplasmic Relationships in Human Cells in Tissue Culture. III. Autoradiographic Study of Interrelation of Nuclear and Cytoplasmic Ribonucleic Acid. ***Lester Goldstein and Julie Micou.*** *Journal of Biophysical and Biochemical Cytology*, v. 6, no. 1, Aug. 1959, p. 1-5 + 2 plates.

12496* Nucleoprotein Changes in Plant Tumor Growth. Transformation of normal cells to tumor cells was accompanied by marked increases in ribonucleoprotein content of affected tissues, reaching a maximum 2 to 3 days after inoculation with virulent bacteria. Increased DNA levels were in part associated with increased mitotic frequency, but also with progressive accumulation of nuclei in the higher DNA classes, formed by repeated DNA doubling without intervening reduction by mitosis. Some normal nuclei of the higher DNA classes (with 2, 4, or 8 times the DNA content of diploid nuclei) were reduced to diploid levels by successive cell divisions without intervening DNA synthesis. ***Ellen Rasch, Hewson Swift, and Richard M. Klein.*** *Journal of Biophysical and Biochemical Cytology*, v. 6, no. 1, Aug. 1959, p. 11-34 + 6 plates.

12497* Studies on Organ Specificity. VI. Cross-Reactions of Thyroid Autoantibodies With Thyroids of Other Species. VII. Production of Antibodies to Rabbit Thyroid by Injection of Foreign Thyroid Extracts. Thyroid autoantibodies of rabbit, dog, guinea pig, and human, cross-reacted with thyroid extracts of the other species, but in general reacted more strongly with homologous antigens. Agglutination by a rabbit thyroid autoantibody of tanned erythrocytes coated with rabbit thyroid extract could be completely inhibited by very small amounts of rabbit thyroid extract, but by none of the other thyroid extracts. ***Noel R. Rose and Ernest Witebsky.*** *Journal of Immunology*, v. 83, no. 1, July 1959, p. 34-48.

12498* Antigenic Stimuli for Transplantation Immunity to Rate Bone Marrow Heterografts in Lethally X-Irradiated Mice. Rat erythrocytes (non-nucleated cells) and rat leukocytes (nucleated cells) both contain antigens that can, when injected into mice prior to lethal irradiation, induce a state of transplantation immunity. ***George W. Santos, Leonard J. Cole, and Richard M. Garver.*** *Journal of Immunology*, v. 83, no. 1, July 1959, p. 66-73.

12499 Alkaloids of Tobacco Smoke. I. Fractionation of Some Tobacco Alkaloids and of the Alkaloid Extract of Burley Cigarette Smoke by Gas Chromatography. II. Identification of Some of the Alkaloids in Burley Cigarette Smoke. ***Louis D. Quin.*** *Journal of Organic Chemistry*, v. 24, July 1959, p. 911-916.

12500 On a Model for the Helix-Random Coil Transition in Polypeptides. I. The Model and Its Thermal Behavior. II. The Influence of Solvent Composition and Charge Interactions on the Transition. ***Leonard Peller.*** *Journal of Physical Chemistry*, v. 63, July 1959, p. 1194-1206.

12501* Lysergic Acid Diethylamide (*LSD-25*): XXIX. The Response Index as a Measure of Threshold Activity of Psychotropic Drugs in Man. Data were obtained on the same

group of five non-psychotic subjects over a period of several years for the threshold doses of *LSD*-25 and related psychotropic compounds. The Response Index for this series of psychotropic compounds related to *LSD*-25 on the basis of *LSD*-25 = 100 is given. ***H. A. Abramson.*** *Journal of Psychology*, v. 48, July 1959, p. 65-78.

12502* Auto-Immunity in Man and Homologous Disease in Mice in Relation to the Malignant Lymphomas. ***Henry S. Kaplan and D. W. Smithers.*** *Lancet*, v. 2, July 4, 1959, p. 1-4.

12503* The Search for Insulin Substitutes. The chemistry, mode of action and clinical applications of the principal synthetic hypoglycaemic drugs are discussed. ***R. B. Hunter, D. M. Shepherd, and J. M. Stowers.*** *Manufacturing Chemist*, v. 30, July 1959, p. 280-284.

12504 Medical Sciences. A selection of papers from the Second International Conference on the Peaceful Uses of Atomic Energy. ***J. C. Bugher, J. Coursaget, and J. F. Loutit, editors.*** v. 2, 288 pp. 1959, Pergamon Press, New York. (QC776 P94n)

12505* Insulin and the Oral Hypoglycemic Agents. A report of the Conference on Insulin and the Oral Hypoglycemic Agents, Indianapolis, Feb., 1959. ***James Ashmore.*** *Metabolism*, v. 8, no. 4, pt. 2, July 1959, p. 469-686.

12506 Microbiology. Text book presents basic concepts of microbiology for the general student who lacks extensive background in biological and physical sciences. Technical material is also included which will meet special microbiological needs of prospective high school and junior college science teachers and of students in nursing, home economics, pharmacy, and sanitary science. ***Louis P. Gebhardt and Dean A. Anderson.*** 2nd Ed. 476 pp. 1959. C. V. Mosby Co., St. Louis. (QR41 G26m2)

12507* Unity in the Specificity of Enzyme and Antibody Induction by the Same Determinant Groups. Antigens containing protocatechuic acid or the β-galactosido- groups coupled to bovine serum albumin have been synthesized. Antibodies to these antigens have been obtained whose specificity toward various hapten analogs parallels the specificities previously found for these compounds acting as inducers, substrates, and inhibitors in induced microbial systems. These results suggest that directed protein synthesis, stimulated by a specific determinant group, takes place by a similar mechanism in all biological systems. ***Stuart W. Tanenbaum, Michael Mage, and Sam M. Beiser.*** *National Academy of Sciences, Proceedings*, v. 45, July 1959, p. 922-929.

12508* Radioactive Fallout Particularly From the Russian October Series. ***W. F. Libby.*** *National Academy of Sciences, Proceedings*, v. 45, July 1959, p. 959-976.

12509* The Somatic Chromosomal Constitution of Some Human Subjects With Genetic Defects. Chromosomal analysis of the somatic cells of a female patient with gonadal dysgenesis revealed only 45 chromosomes, the γ chromosome being missing. In contrast to these findings, the chromosomes of skin cells of patients with Marfan's syndrome, phenyl ketonuria, and female pseudohermaphroditism and of the bone marrow cells of a patient with Gaucher's disease have been found to be normal with respect to number and gross morphology. ***J. H. Tjio, T. T. Puck, and A. Robinson.*** *National Academy of Sciences, Proceedings*, v. 45, July 1959, p. 1008-1016.

12510* The Relative Homogeneity of Microbial DNA. ***Ronald Rolfe and Matthew Meselson.*** *National Academy of Sciences, Proceedings*, v. 45, July 1959, p. 1039-1043.

12511* Helical Arrangements in Synthetic and Natural Polynucleotides. Positive rotation of partially H-bonded coil polynucleotides such as RNA is ascribed to presence of short helical regions held together by H bonds between the bases. ***Jacques R. Fresco.*** *New York Academy of Sicences, Transactions*, v. 21, no. 8, June 1959, p. 653-658.

12512* Electronic Command of Movement and Behavior. Data presented demonstrate that electric stimulation of specific areas of the brain can force an animal to perform complex acts indistinguishable from voluntary movements and can modify human behavior to the extent of producing fear or increasing friendliness and verbal output. Electric stimulation creates impulses similar to physiological functions in that the evoked effects not only resembled spontaneous activities, but also combined or competed with them. Electronic command overwhelmed the "will" of the experimental subject and always prevailed if sufficient intensity was applied. ***José M. R. Delgado.*** *New York Academy of Sciences, Transactions*, v. 21, no. 8, June 1959, p. 689-699.

12513* The Purification and Action of Tumor Factor Extracted From Mouse and Human Neoplastic Tissue. Refined extracts of human and mouse tumor tissue have been prepared by a technique called the BFK technique. Injection of refined extracts into C3H(f) mice induced primary parotid tumors, mammary tumors, adrenal tumors, soft tissue tumors, and leukemia. ***Lawrence Burton, Frank Friedman, Robert Kassel, Martin L. Kaplan, and Antonio Rottino.*** *New York Academy of Sciences, Transactions*, v. 21, no. 8, June 1959, p. 700-707.

12514 Outlines of Enzyme Chemistry. A text book for senior undergraduate and beginning graduate students in the general subject of enzyme chemistry, and research workers in fields other than enzymology. ***J. B. Neilands and Paul K. Stumpf.*** 2nd Ed., (Rev.) 411 pp. 1958. John Wiley & Sons, New York. (QP601 N31o2)

12515* Robert Emerson Memorial Issue. This issue of Plant Physiology is dedicated to Robert Emerson. It is composed of 33 articles on one major research topic, photosynthesis. Within that broad field many, though not all, currently active lines of investigation are represented. *Plant Physiology*, v. 34, no. 3, May 1959, p. 179-363.

12516* Tobacco Consumption and Mortality From Cancer and Other Diseases. Report summarizes mortality experience of nearly 200,000 policyholders of U. S. Government life insurance from July 1954 through December 1956. Death rate from all causes for men who have used tobacco is 32 percent greater than that for men who have never smoked. Leading cause of death among the policyholders is coronary heart disease. Forty-four percent of the number of observed deaths and 45 percent of number of excess deaths—difference between number of observed deaths and number of deaths expected on the basis of rates for nonsmokers—for cigarette-only smokers were attributed to coronary heart disease. ***Harold F. Dorn.*** *Public Health Reports*, v. 74, July 1959, p. 581-593.

12517* The Configuration of Proteins in Solution. An extensive review covering the α-helix model and its limitations, crystals, films and solutions; the helix-random coil transition; theories of configurational change in proteins; hydrodynamic determination of shape; molecular configuration from light-scattering and viscosity data; optical rotation and rotary dispersion; and the tertiary structure of proteins. ***S. J. Leach.*** *Reviews of Pure and Applied Chemistry*, v. 9, no. 1, Mar. 1959, p. 33-85.

12518 Leukemogenic Activity of Filtrates From Radiation-Induced Lymphoid Tumors of Mice. Cell-free filtrates elicited, on injection into newborn isologous hosts, a lymphoma incidence of 15 to 19%. In control mice the incidence is about 1%. ***Miriam Lieberman and Henry S. Kaplan.*** *Science*, v. 130, Aug. 14, 1959, p. 387-388.

12519 Biophysical Approach Toward Tumor Regression in Mice. An external electrical source of low magnitude was used in a series of experiments to alter inherent tumor electrical potentials in mice. Total tumor regressions were obtained among some of the treated mice. ***Carroll E. Humphrey and E. H. Seal.*** *Science*, v. 130, Aug. 14, 1959, p. 388-390.

12520* Precise Zone of Localization of Anti-Kidney Antibody in Various Organs. *In vivo* localization of antibodies prepared in rabbits against rat kidney was observed in certain structures of ovary and spleen as well as in kidney and adrenal. A lower concentration was observed on structures in thyroid, lymph node and liver, whereas none was seen in testes, lung, skin, brain, and heart. ***Raymond Hiramoto, Jerzy Jurandowski, Joseph Bernecky, and David Pressman.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 3, July 1959, p. 583-586.

12521* Third Component of Human Complement: Resolution Into Two Factors and Demonstration of a New Reaction Intermediate. ***A. B. Taylor and M. A. Leon.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 3, July 1959, p. 587-588.

12522* The Dynamics of Coliphage Plaque Formation. I. Macroplaque Experiments. On phage assay plates, bacteria multiply to form many small clones; phage infecting one bacterium multiplies, infects the clone, and the progeny diffuse to infect other clones. This process continues until changes take place in the bacterial population to impede or halt multiplication. ***Arthur L. Koch.*** *Virology*, v. 8, no. 3, July 1959, p. 273-292.

12523* Possible Genetical Pathways for the Biosynthesis of Blood Group Mucopolysaccharides. ***Winifred M. Watkins and W. T. J. Morgan.*** *Vox Sanguinis*, v. 4, no. 2, Apr. 1959, p. 97-119.

CERAMICS AND CONCRETE

12524 Effect of Impurities on Electrical Solid-State Properties of Barium Titanate. $BaTiO_3$ single crystals with various impurity additions were grown and their effect on crystal quality, switching behavior, and electrical solid-state properties was investigated. ***Charles F. Pulvari.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 355-363.

12525 Piezoresistance and Piezocapacitance Effects in Barium Strontium Titanate Ceramics. A large piezoresistance response to hydrostatic pressure is reported for a series of ceramic compositions in the system Ba Sr La titanate (Ba, Sr, La)TiO_3. This property appears to be closely associated with the Curie region (cubic-tetragonal phase transition) and the phenomenon of a positive temperature coefficient of resistance for these same compositions. ***J. A. Sauer, S. S. Flaschen, and D. C. Hoesterey.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 363-366.

12526 Dielectric Studies of Some Borate and Phosphate Glasses. Some borate glasses, with sag points of 350 to 500 C, of high specific resistance and low power factor were prepared. The power factor of the glasses was measured to 250 C, and the resistivity was measured up to temperatures approaching the transformation region. Borate glasses have higher resistivities and power factors than phosphate glasses. An increase in sag point of lead borate glasses by substitution of PbO with BaO, Al_2O_3, or SiO_2 improves their dielectric properties. Depending on the type of glass, the dielectric constant varies linearly with the density of the glass. ***Chikara Hirayama and Mildred M. Rutter.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 367-373.

12527 Dependence of Mechanical Strength of Brittle Polycrystalline Specimens on Porosity and Grain Size. An empirical equation form, approximating the apparent dependence of the strength of brittle polycrystalline specimens on the combined effect of porosity and grain size, was developed from concepts and data in the literature. The form is shown to be applicable to data for thoria and Cr carbide specimens. ***F. P. Knudsen.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 376-387.

12528 High-Temperature Mechanical Properties of Ceramic Materials. II. Beta-Eucryptite. High stresses arise in sintered β-eucryptite ($LiO_2 \cdot Al_2O_3 \cdot 2SiO_2$) during cooling from the firing temperature because of its extreme anisotropy of thermal expansion. These stresses cause extensive fracturing of the crystals, resulting in abnormally low mechanical property values at room temperature. During reheating, many fractures recombine, causing increase in strength and in elastic modulus with increasing temperature. Beta-eucryptite creeps under load at room temperature because of additional fracturing and the propagation of fractures. ***E. A. Bush and F. A. Hummel.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 388-391.

12529 On the Growth of Alpha Aluminum Oxide Platelets From the Vapor. The formation of α-Al_2O_3 microcrystals on objects heated in resistance furnaces with an Al_2O_3 tube and a H atmosphere is reported. The crystals grow from the vapor produced by the reaction between the Al_2O_3 furnace tube and the H atmosphere. Evidence for growth by the screw dislocation mechanism is presented. ***John E. May.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 391-393.

12530 Oxygen Ion Mobility in Cubic $Zr_{0.85}Ca_{0.15}O_{1.85}$. Determined by exchange measurements employing the stable isotope O^{18} and mass spectrometer analysis. Measurements of electrical conductivity were carried out as a function of both temperature and O pressure. Results indicate that the conductivity is wholly ionic with a transfer number near unity for the O ion. ***W. D. Kingery, J. Pappis, M. E. Doty, and D. C. Hill.*** *American Ceramic Society, Journal*, v. 42, Aug. 1959, p. 393-398.

12531* Properties of Nuclear Shielding Concrete. General shielding requirements are discussed with particular emphasis on fast neutron shields. Concrete materials which are effective in meeting the requirements are outlined and basic principles involved are explained. The concrete mix, type and source of materials, and strength properties of the shields of four similar nuclear reactors are compared. Effects on concrete setting time and strength of adding B in the form of mineral colemanite and borocalcite and the counter effects of Ca chloride are described. ***James O. Henrie.*** *American Concrete Institute, Journal*, v. 31, *ACI Proceedings*, v. 56, no. 1, July 1959, p. 37-46.

12532* PCA Research and the Cement Story. Describes Portland Cement Association's contribution to cement utilization. ***Kenneth E. Trombley.*** *American Engineer*, v. 29, Aug. 1959, p. 17 + 6 pages.

12533 Mixing Equipment for Ceramic Materials. III. Design, construction, and operating characteristics of pugmills, roller mills, muller and other pan mixers, rotary batch mixers and blenders, conical blenders, drum rollers and tumblers, screw mixers, and granulating mixers. ***Sidney Levine.*** *Ceramic Age*, v. 74, no. 2, Aug. 1959, p. 27-33.

12534 Cutting, Grinding and Lapping of Piezoelectric Crystals. ***Sverre Eide.*** *Ceramic Age*, v. 74, no. 2, Aug. 1959, p. 34 + 7 pages.

12535 Rubidium in Lead and Barium Glasses. Properties of several experimental glasses were determined. ***H. E. Simpson.*** *Glass Industry*, v. 40, Aug. 1959, p. 411 + 10 pages.

12536 The Industrial Graphite Engineering Handbook. Graphite manufacture, grades, and applications; mechanical, thermal, electrical and chemical properties; nuclear graphite. Sections individually paged. 1959. National Carbon Company, New York. (TP261.G7 N21i)

12537 Symposium on Aluminum Industry Refractories. II. Behavior of refractories in contact with molten Al, types of refractories being utilized in Al melting applications. *Industrial Heating*, v. 26, Aug. 1959, p. 1607 + 3 pages.

12538* Sintering of Uranium Oxides of Composition UO_2 to U_3O_8 in Various Atmospheres. Studies of sintering behavior at various temperatures of oxides of varying particle size and of compositions in the range UO_2 to U_3O_8 in sintering atmospheres of A, N, CO_2, vacuum, H and C monoxide. Both particle size and composition influence sintering behavior. The beneficial effect of O in excess of stoichiometry is believed to be chiefly due to the increased plasticity of $UO_{(2+x)}$ compared with $UO_{2.0}$. Oxygen in excess of stoichiometry may be readily removed by H reduction at 1200-1400 C. Oxygen thus behaves as an ideal additive, promoting sintering and being readily removed afterwards. ***J. Williams, E. Barnes, R. Scott, and A. Hall.*** *Journal of Nuclear Materials* v. 1, no. 1, Apr. 1959, p. 28-38.

12539* The Plastic Deformation of Uranium Oxides Above 800°C. Sintered $UO_{2.04}$ and $UO_{2.16}$ can be deformed plastically at about 800 C, the corresponding temperature for $UO_{2.0}$ being about 1600 C. The creep characteristics of UO_{2+x} are similar to those of metals. No conclusive evidence has been obtained as to which of several possible atomic mechanisms is responsible for flow in these materials. ***R. Scott, A. R. Hall,***

and J. Williams. *Journal of Nuclear Materials*, v. 1, no. 1, Apr. 1959, p. 39-48.

12540* High Temperature Creep and Anelastic Phenomena in Polycrystalline Refractory Oxides. High temperature creep and anelastic phenomena in polycrystalline Al_2O_3 and BeO were studied. Addition of small amounts of Cr_2O_3 or La_2O_3 to Al_2O_3 and of MgO to BeO introduces additional grain boundary relaxation peaks at lower temperatures and reduces grain boundary viscosity. The beneficial effects of these additives in improving the high temperature ductility of refractory oxides are briefly discussed. A correlation between the experimentally observed "steady-state" creep rates and those calculated suggests that the Nabarro-Herring mechanism may predominate in the creep of polycrystalline BeO and possibly other oxides at high temperatures and low stresses. ***Roger Chang.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 174-181.

12541 The Successive Determination of Manganese, Sodium and Potassium in Cement by Flame Photometry. ***C. L. Ford.*** *Portland Cement Association, Research Department Bulletin* 104, Mar. 1959, 15 pp. (TP883 P83b Vis.)

12542 Properties of Rutile (Titanium Dioxide). Crystal structure; X-ray properties; criteria of bond type; parameters for the evaluation of experimental data of semiconductors; electrical conductivity; thermopower; the Hall effect; magnetic susceptibility; thermal conductivity, specific heat, and various physical properties; dielectric and optical properties; adsorption and surface layers; band structure of rutile; thermodynamic properties and reduction. ***F. A. Grant.*** *Reviews of Modern Physics*, v. 31, no. 3, July 1959, p. 646-674.

12543 Piezoelectric Ceramic Materials. Dielectric strength, thermal expansion and conductivity, response to high unidirectional and hydrostatic stress, and crystal growth. ***Don Berlincourt.*** *U. S. Atomic Energy Commission, SC*—4306, Apr. 27, 1959, 96 pp. (UF767 Un3.1sc Contin.)

12544 Uranium Dioxide Fuel Materials With Improved Thermal Conductivity. In order to improve the thermal conductivity of nuclear fuels consisting basically of UO_2, several metallic and ceramic materials were added to the fuel. Cermet-type fuel cores with the framework consisting of Mo or Nb and UO_2 were prepared; however, these cermets, as favorable as they are for better heat transfer, are rather unfavorable with respect to their neutron economy. Small amounts of ceramic additions, such as the oxides of Y or Nb, which form solid solutions with UO_2, have considerably improved the thermal conductivity of the fuel material, with very little effect on neutron economy. ***H. Shapiro and R. M. Powers.*** *U. S. Atomic Energy Commission, SCNC*-271, June 1959, 22 pp. (UF767 Un3.1scn Contin.)

See also: **12565** (tricalcium silicate); **13017** (SiC heating elements); **13110** (melting uranium in graphite); **13150** (closure for crucible furnace); **13232** (use of ceramic cutting tools); **13292** (UC-UN system).

CHEMICAL ENGINEERING

12545* Metering Pump Circuit Eliminates Viscosity Effect. ***J. R. Fawcett.*** *Applied Hydraulics & Pneumatics*, v. 12, Aug. 1959, p. 86.

12546 Thermodynamic Properties of Some Organic Compounds. I. PVT Relationships and Calculated Thermodynamic Properties for Normal Butanol. ***L. W. Shemilt, R. W. Esplen, and R. Singh Mann.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 4, Aug. 1959, p. 142-152.

12547 The Effect of Pressure on the Enthalpy of Gases. Enthalpy-correction chart based on the law of corresponding states was constructed using compressibility factor information. The results from this correlation agree with more sophisticated methods already presented in the literature. ***Reza Kordbachen and Chi Tien.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 4, Aug. 1959, p. 162-166.

12548 New Agent for Fluorination. Du Pont's SF_4 replaces O with F, opens door to new fluorinated products. *Chemical and Engineering News*, v. 37, no. 34, Aug. 24, 1959, p. 40.

12549 Small Volume Pure Hydrogen at Bulk Cost. Produced by low temperature techniques, cost of this H equals that of electrolytic product. ***C. S. Cronan.*** *Chemical Engineering*, v. 66, Aug. 10, 1959, p. 60-62.

12550 Chemical Engineering Unit Operations Help Solve Atomic Power Plant Problems. ***C. F. Stolzenbach.*** *Chemical Engineering*, v. 66, Aug. 24, 1959, p. 123-128.

12551 Molecular Sieves for Gas Drying. Sun Oil found molecular sieves superior to other desiccants for drying refinery off-gases. ***G. S. Cochrane.*** *Chemical Engineering*, v. 66, Aug. 24, 1959, p. 129-132.

12552 Phantom Heat Exchangers Require Fewer Lines, Make Flow Diagrams Easier to Read. For easier comprehension of process flowsheets, minimize overlapping lines by adding duplicate exchangers near effluent streams which provide the necessary heat. ***Sy H. Friedman and H. R. Garrison.*** *Chemical Engineering*, v. 66, Aug. 24, 1959, p. 133 + 1 page.

12553 For Handling Difficult Materials—Don't Overlook Diaphragm Pumps. ***Carl Jahreis.*** *Chemical Engineering*, v. 66, Aug. 24, 1959, p. 135-138.

12554 Ultra-Pure Water for Less Than One Mill Per Gal. Can supply 50 gpm of turbidity-free, non-organic, demineralized water for use in H_2O_2 manufacture. ***L. S. Tracy.*** *Chemical Processing*, v. 22, Aug. 1959, p. 30 + 1 page.

12555 Heat-Saving Tricks Cut Heavy-Water Costs. Reveals U. S. Patent 2,895,803 to Jerome Spevack that slashed heavy-water production costs from $110/lb. to the present $13.50/lb. *Chemical Week*, v. 85, no. 5, Aug. 1, 1959, p. 45-46.

12556 pH Control for Cooling Towers. Economics of control are discussed. *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 47A-48A.

12557 Performance of Packed Distillation Columns. Shows that the efficiency of packed distillation columns is low when the mixture undergoing distillation is dilute. ***Henryk Sawistowski and William Smith.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 915-918.

12558 Gasket Reactions and Sealing Pressures in Vessels. A method of sealing pressure calculation was developed, which is applicable to flanged connections and to special closures of high pressure vessels. ***G. P. Kotelewsky.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 949-951.

12559 Differential Thermal Analysis of Vanadium Pentoxide and Silica. Analysis shows that no reaction occurs between these materials and V_2O_5, but that a phase transition does take place. ***C. B. Murphy and R. R. West.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 952.

12560 Three Routes to Ethylene Glycol. Follows the formation of ethylene chlorohydrin from ethylene, its saponification to ethylene oxide, purification of ethylene oxide, and its conversion to ethylene glycol. ***P. W. Sherwood.*** *Industrial Chemist*, v. 35, June 1959, p. 278-282.

12561* Usable Water. I. An analytical discussion of water supply and consumption. ***Everett P. Partridge.*** *Industrial Wastes*, v. 4, no. 4, July 1959, p. 66-69.

12562* Pump Capacity Units-Head Elements. Units of capacity, factors entering into heads, conversion of pressures to feet of liquid, gage and absolute units, effect of altitude on pressure, vapor pressure and head terms are discussed. ***Roy Carter and Igor J. Karassik.*** *Industrial Wastes*, v. 4, no. 4, July 1959, p. 81-86.

12563 Organic Fouling of Strongly Basic Anion-Exchange Resins. Shows that humic acids, present in the raw water supply of a power station, are adsorbed by the strongly basic resin in a mixed-bed deionization unit. Such acids are not completely removed during regeneration of the resin, and their presence

reduces capacity. ***A. L. Wilson.*** *Journal of Applied Chemistry*, v. 9, pt. 7, July 1959, p. 352-359.

12564 Chemical Instrumentation. IV. Vacuum Pumps. Articles present a survey of the basic principles, characteristics, and limitations of instruments which find important applications in chemical work. ***S. Z. Lewin.*** *Journal of Chemical Education*, v. 36, Aug. 1959, p. A433 + 9 pages.

12565 The Ball-Mill Hydration of Tricalcium Silicate at Room Temperature. The stoichiometry of the reaction is given. The initial products of the reaction are $Ca(OH)_2$ (both crystalline and amorphous) and a Ca silicate hydrate, designated as "hydrate III". The latter shows marked similarities to the Ca silicate hydrate, tobermorite, produced by other methods of hydration of Ca_3SiO_5. ***D. L. Kantro, Stephen Brunauer, and C. H. Weise.*** *Journal of Colloid Science*, v. 14, no. 4, Aug. 1959, p. 363-376.

12566 Limited-Leakage vs. Canned-Motor Pumps. Relative costs: Wear and maintenance. ***L. G. Hauser.*** *Nucleonics*, v. 17, Aug. 1959, p. 97-99.

12567* Pumping Solids Through a Pipeline. An historical account of piping solids. Discusses the technical and economic feasibility of transporting solids through pipelines. ***Julian Nardi.*** *Pipe Line News*, v. 31, Aug. 1959, p. 26 + 5 pages.

12568* Some Causes of Boiler Gasket Leakage. Some little-known facts to help minimize a common, annoying problem. ***C. J. Schafer.*** *Plant*, v. 20, Aug. 1959, p. 31-33.

12569 Problems in the Use of Sewage Plant Effluent for Boiler and Cooling Purposes. Sewage plant effluent can be used satisfactorily in recirculating cooling systems and as boiler makeup provided it is adequately treated to avoid operating problems such as organic growths, deposits and corrosion in cooling systems and foaming, carryover and ammonia corrosion in boiler and steam systems. ***John E. Tarman and James H. Richards.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 1-7. (TD201 En33a)

12570 Experiences With the High Rate of Flow Demineralization. ***I. B. Dick and P. L. Silliman.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 65-73. (TD201 En33a)

12571 Special Operating and Regenerating Technique for Ion Exchange. Describes the historical evolution of ion exchange plants for water treatment and discusses typical specifications which usually determine the size of equipment used. ***H. W. Frazer.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 83-96. (TD201 En33a)

12572 Panel on Handling and Feeding Chemicals to Water Treating Equipment. I. Handling and Feeding Acid to Demineralizers; II. Handling and Feeding Caustic Soda to Demineralizers; III. Disposal of Water Treatment Wastes; IV. Handling and Feeding Chemical Solutions to Clarifying and Softening Equipment; V. Handling and Feeding Dry Chemicals to Clarifying and Softening Equipment. I. ***T. P. Harding.*** II. ***Ivan S. St. John.*** III. ***E. G. Paulson.*** IV. ***James E. Starry.*** V. ***J. F. Wilkes.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 97-131. (TD201 En33a)

12573 Field Testing of Ion Exchange Resins. The field method consists of placing a screened basket containing the resin in the bed of an existing and operating commercial ion exchange installation. Samples of the resin are periodically withdrawn from the basket and evaluated by standard test procedures. ***Robert Kunin, Norman W. Frisch, and F. X. McGarvey.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 133-147. (TD201 En33a)

12574 Developments in the Understanding of Ion Exchange. ***L. F. Wirth, Jr., and A. M. Fradkin.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 149-163. (TD201 En33a)

12575 Operating Experiences With Automatic Valveless Gravity Filters. Gives a description of the operating cycles of the above and describes some of the development problems and operating experiences. ***A. W. Kingsbury, E. L. Phillips, and J. S. Kneale.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsyvlania, Pittsburgh. 1958, p. 165-175. (TD201 En33a)

12576 Russian and Eastern European Water Treatment Practices. Nature of water supplies in Russia; general practices in central station utility plants; and typical natural waters in the U.S.S.R. ***V. J. Calise.*** Paper from "Proceedings of the Nineteenth Annual Water Conference, Dec. 8-10, 1958, Pittsburgh, Pennsylvania", Engineers Society of Western Pennsylvania, Pittsburgh. 1958, p. 177-193. (TD201 En33a)

12577 Scale-Up in Practice. A collection of seven papers which review the general field of scale-up, demonstrate the inter-relationship of its facets, introduce recent developments, discuss some common problems and provide some ideas on their solution. ***Richard Fleming, editor.*** 134 pp. 1958. Reinhold Publishing Corporation. New York. (TP157 F62s)

12578* Flow Evaluation of Aerosols. ***L. Cohen, R. J. Meyer, and J. S. Wolff.*** *Soap and Chemical Specialties*, v. 35, Aug. 1959, p. 77 + 3 pages.

12579* Radiometric Instrumentation and Its Application to Process Monitoring. ***H. Bisby and F. D. Seymour.*** *Society of Instrument Technology, Transactions*, v. 11, no. 2, June 1959, p. 87-94.

12580* Electrode Problems in Plant pH Measurement. ***G. Mattock.*** *Society of Instrument Technology, Transactions*, v. 11, no. 2, June 1959, p. 105-113.

12581* The Magnetic Flowmeter. Operation of the device, its history and applications. ***B. W. Balls and K. J. Brown.*** *Society of Instrument Technology, Transactions*, v. 11, no. 2, June 1959, p. 123-130.

12582* Propeller Flowmeters With Electronic Indication. ***F. R. Allen.*** *Society of Instrument Technology, Transactions*, v. 11, no. 2, June 1959, p. 131-136.

12583 Rust Protection of Steel Structures in the Chemical Industry. The preparation of the surface for coating, the composition of the coat, the control of the removal of rust and of the coating, consideration of the weather, observation and maintenance of the coating, and constructional measures are discussed. (*In German.*) Rostschuss der Stahlkonstruktionen in der chemischen Industrie. ***G. Sille and O. Damm.*** *Technik*, v. 14, July 1959, p. 469-471.

12584 Uranium Production Technology. Chemistry of U processing; purification processes; producing UO_3, UO_2, UF_4, and UF_6; fabrication techniques. ***Charles D. Harrington and Archie E. Ruehle, editors.*** 579 pp. 1959. D. Van Nostrand Company, Inc., New York. (TN 799.U7 H23u.)

12585 Laboratory Development of a Process for Separating Barium-140 From MTR Fuel. The results of all laboratory research and development on the process for the above are presented. The steps include caustic dissolution, separation of Ba and Sr with fuming nitric acid and removal of Sr by the chromate-acetate method. ***E. L. Anderson, R. S. MacCormack, and C. M. Slansky.*** *U. S. Atomic Energy Commission, IDO-14445*, Mar. 27, 1959, 109 pp. (UF767 Un3.1id Contin.)

12586 Production of Porous Pellets of Hydrated Orange Oxide. An efficient and economical process for the continuous production of porous pellets of hydrated UO_3. Consists of feeding and mixing UO_3 powder with dilute aqueous ammonia fol-

lowed by extruding and curing of the resulting paste. ***Paul W. Henline, Earl W. Mautz, and Edward J. Walter.*** *U. S. Atomic Energy Commission, NLCO-718*, July 21, 1959, 57 pp. (UF767 Un3.1nL Contin.)

12587 Investigation of Oxygen Production by Metal Chelates. The metal chelate process is not economical at this time for producing tonnage O required in coal gasification. However, the salcomine process may possibly be used in small-scale production of O, such as for welding on shipboard where cost is not a primary consideration. The most favorable conditions for such applications are discussed. ***R. F. Stewart, P. A. Estep, and J. J. S. Sebastian.*** *U. S. Bureau of Mines Information Circular* 7906, 1959, 38 pp. (TN21 Un3i Vis.)

See also: **12609** (standards on soaps and other detergents); **12903** (ultrasonic flowmeter); **13095** (corrosion by sour gas condensates).

CHEMISTRY—ANALYTICAL

12588 Analytical Chemistry of Polymers. I. Analysis of Monomers and Polymeric Materials. Plastics - Resins - Rubbers - Fibers. ***Gordon M. Kline, editor.*** v. XII. Pt. I. 666 pp. 1959. Interscience Publishers, New York. (QD281.P6 K68a)

12589 Spectrochemical Rapid Determination of Gases in Steels. Successful attempt at cutting the time needed for determination of CO, N, and H extracted from metals for a total of 2½-4 minutes for these gases (20 seconds for a single gas analysis) and prospects of using this new rapid and highly sensitive method for furnace control tests. Analysis lines recommended; measuring procedure. Calibration curves for CO and N. Dependence of total emission on H content. ***W. Koch, S. Eckhard, and F. Stricker.*** *Henry Brutcher Translation No.* 4558, 20 pp. (From *Archiv Eisenhüttenwesen*, v. 30, no. 3, 1959, p. 137-144.) Henry Brutcher, Altadena, Calif.

12590* Indirect Complexometric Titration of Beryllium With Ethylenediaminetetraacetic Acid. ***Seizo Misumi and Tomitsugu Taketatsu.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 6, June 1959, p. 593-596.

12591* A New Compound of Tin(IV) With 8-Quinolinol and Its Use in Gravimetric Analysis. Tin(IV) is precipitated quantitatively from 0.2 *N* HCl solution by adding 8-quinolinol (oxine). ***Hiroshi Hamaguchi, Nagao Ikeda, and Kazuya Osawa.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 6, June 1959, p. 656-657.

12592 Gas-Liquid Chromatography of Natural Products and Their Derivatives. ***G. Eglinton, R. J. Hamilton, R. Hodges, and R. A. Raphael.*** *Chemistry & Industry*, 1959, no. 30, July 25, p. 955-957.

12593 Quantitative Determination of Arsenic Residues in Plant Materials. Arsenic measured by means of the molybdenum blue reaction. ***Helmut Frehse and Helmut Tietz.*** *Journal of Agricultural and Food Chemistry*, v. 7, Aug. 1959, p. 553-558.

12594 Thermogravimetric Analysis: The Method of Isobaric Dehydration. The influence of the recording technique upon the form of dehydration isobars shows that kinetic factors are important, especially in the interpretation of curves for composite specimens. A "quasi-static" technique is described which is capable of greater resolution than the usual dynamic recording methods. New data, obtained using this technique, are reported for hydrated Ca silicates and related compounds examined in powder form. ***E. Roy Buckle.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1231-1235.

12595* X-Ray Fluorescence Analysis in Metallurgy. Allows a rapid elementary spectrographic analysis, and proves to be a complementary method in the case of emission spectrography when high concentrations are involved or in order to bring a chemical determination to a successful completion when the concentrations are very low. (*In French.*) L'analyse par fluorescence X en métallurgie. ***H. Bizouard and G. Pomey.*** *Métaux Corrosion-Industries*, v. 34, July-Aug. 1959, p. 302-315.

12596 Symposium on Solvent Extraction in the Analysis of Metals. 54 pp. 1958. American Society for Testing Materials, Philadelphia. (QD133 Am35ss)

12597 Symposium on Spectrochemical Analysis for Trace Elements. 79 pp. 1958. American Society for Testing Materials, Philadelphia. (QD95 Am35s)

12598 High Temperature Gas Chromatography of Aromatic Hydrocarbons: Instrument Design and Exploratory Studies at Temperatures up to 430° C. The high temperature technique has been used for both qualitative and quantitative analysis of irradiated polyphenyl reactor coolant-moderator materials. ***Robert A. Baxter and Robert T. Keen.*** *U. S. Atomic Energy Commission, NAA-SR-3154*, June 1, 1959, 30 pp. (UF767 Un3.1na Contin.)

See also: **12541** (analysis of cement); **12799** (analysis of anodizing solutions); **13278** (extraction of inclusions from steel).

CHEMISTRY—INORGANIC AND GENERAL

12599* Tungstates of Zirconium and Hafnium. According to the analytical data, the formulas of the synthetical compounds were $ZrOWO_4$-1, $5H_2O$, $ZrOWO_4$, and $HfOWO_4 \cdot 2H_2O$, $HfOWO_4$. The conversions of the tungstates of zirconyl and of hafnil, which take place on heating, were investigated by use of the Kurnakov pyrometer and the balance of continuous weighing. On interaction with HCl and H_2SO_4 the tungstate of zirconyl decomposes, but the Hf compound does not change. (*In Russian.*) Vol'framaty tsirkoniia i gafniia. ***V. I. Spitsyn, L. N. Komissarova, and Z. A. Vladimirova.*** *Akademiia Nauk SSSR, Doklady*, v. 127, no. 1, July-Aug. 1959, p. 120-123.

12600 The Preparation and Properties of Ammonia-Triborane, $H_3NB_3H_7$. Ammonia-triborane can be made from tetraborane by a series of reactions analogous to those used in preparing ammonia-borane, H_3NBH_3, from diborane. A method for synthesizing and purifying the compound in 10 to 20 g. lots also is given. ***G. Kodama, R. W. Parry, and J. C. Carter.*** *American Chemical Society, Journal*, v. 81, July 20, 1959, p. 3534-3538.

12601 Boron-Nitrogen Compounds. I. Syntheses of B-Aminoborazines. The reaction of B-trichloroborazines with amines produces the same type of compounds as the reactions of aminodichloroboranes with anhydrous ammonia or amines. ***Kurt Niedenzu and John W. Dawson.*** *American Chemical Society, Journal*, v. 81, July 20, 1959, p. 3561-3564.

12602 The Reaction of Bis-(cyclopentadienyl)-titanium-(IV) Bromide With Different Chlorides in Various Solvents. The rates of reaction with $LiCl_2$ and with benzyldimethyloctadecylammonium chloride to give bis-(cyclopentadienyl)-titanium(IV) chloride were investigated. ***Arne Jensen and Fred Basolo.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3813-3818.

12603 Infrared Absorption Studies of Inorganic Coordination Complexes. XX. Cobalt(III) Ammine Complexes Containing Some Coordinated Anions. XXI. Nitrosopentammineeobalt Halides and Nitrate. XXII. Infrared Studies of Methylthiourea and Its Metal Complexes. XX.-XXI. ***E. P. Bertin, et al.*** XXII. ***T. J. Lane, et al.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3818-3826.

12604 Preparation, Properties and Structure of Cadmium Peroxide. A compound shown to be CdO_2 has been prepared and some of its properties are given. The crystal structure of this material has been studied by powder diffraction methods. Patterns were indexed on the basis of a cubic pyrites-type lattice with the Cd atoms occupying the fcc positions. A value for a_0 of 5.313 ± 0.003 Å. and an oxygen-oxygen peroxide distance of 1.49 ± 0.04 Å. were found. ***C. W. W. Hoffman, R. C. Ropp, and R. W. Mooney.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3830-3834.

12605 The Tungstic Acids. A chemical and X-ray investigation was made of the solid phases precipitated from W(VI) solutions by strong acids at concentrations of 0.2 to 9.0 *N* and temperatures of 25, 50 and 100 C. Of the four phases obtained by direct precipitation two phases, $WO_3 \cdot 2H_2O$ and $WO_3 \cdot H_2O$, were identified as hydrates by comparison with the isomorphous Mo compounds. A new phase was discovered in studying the reactions of the hydrates with Na_2WO_4 solution. ***Meyer L. Freedman.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3834-3839.

12606* Studies on Copper Phthalocyanine and Its Chlorinated Derivatives Based Upon the X-Ray Diffraction Patterns. ***Masahiro Shigemitsu.*** *Chemical Society of Japan, Bulletin,* v. 32, no. 6, June 1959, p. 607-616.

12607 Chemistry of the Co-ordinate Compounds. A symposium sponsored by The Italian National Research Council, The International Union of Pure and Applied Chemistry, and The Italian Chemical Society. (*In English and Italian.*) 638 pp. 1958. Pergamon Press, New York. (QD471 C76c)

12608 The Fluorination of Metallic Titanium. Metallic Ti was fluorinated by elemental F at 100, 200, and 300 C and at partial pressures of F of 0.25, 0.50, 0.75, and 1.0 atm. The effect of flow rates was studied briefly. Activation energy for the reaction is approximately 25.6 kcal/mole. ***M. J. Steindler, D. V. Steidl, and R. K. Steunenberg.*** *U. S. Atomic Energy Commission, ANL-6002,* June 1959, 6 pp. (UF767 Un3.1an Contin.)

CHEMISTRY—ORGANIC

12609 ASTM Standards on Soaps and Other Detergents. Specifications, methods of analysis, definitions of terms. p. 707-949. Dec. 1958. American Society for Testing Materials, Philadelphia. (TP991 Am35s)

12610* Synthesis of New Sugar Derivatives of Potential Antitumor Activity. III. 2-Halogeno-ethylamino- and Ethyleneimino Derivatives of Sugar Alcohols. IV. 2-Dichlorodiethylamino Derivatives of Monosaccharides. (*In German.*) Uber die Synthese neuer Zuckerderivate mit potentieller cytostatischer Wirksamkeit. III. Uber 2-Halogenathylamino- und Athyleniminoderivate von Zuckeralkoholen. ***L. Vargha, L. Toldy and E. Kasztreiner.*** IV. Über 2-Dichlordiäthylaminoderivate einiger Monosaccharide. ***L. Vargha, O. Fehér, and S. Lendvai.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 19, nos. 2-3, 1959, p. 295-314.

12611* A Spectroscopic Study of α-Metalated Aldehydes and Ketones and Lithium Vinylate. The obtained data of the infrared and ultraviolet spectra of α-metalated oxo-compounds are a new argument in favor of the presence of a σ-π conjugation in such compounds, which appears in a series of chemical reactions. Infrared and ultraviolet spectra of $CH_2{=}CHOL$ showed a complete absence of absorption, characteristic for the carbonyl group. (*In Russian.*) Spektroskopicheskoe issledovanie α-Metallirovannykh al'degidov i ketonov i vinilata litiia. ***A. N. Nesmeianov, L. A. Kazitsyna, I. F. Lutsenko, and G. A. Rudenko.*** *Akademiia Nauk SSSR, Doklady,* v. 127, no. 1, July-Aug. 1959, p. 115-116.

12612* Studies in the Field of Synthesis and Transformations of Oxygen-Containing Organo-Silicon Compounds. VIII. Synthesis and Study of Properties of Low-Molecular Methyl-α-naphthyl-silanediol Ethers. It was found that it is possible to obtain low-molecular ethers from silanediols and alcohols. Four products were synthetically obtained: dibutyl ether of methyl-α-naphthyl-silanediol; symmetric di(methyl-d-naphthyl-n butoxy-siloxene; tri-methyl-1,3,5-tri-d-naphthyl-1, 3,5-di-n-butoxy-1.5-trisiloxene and tetra-methyl-1,3,5,7,-tetra-α-naphthyl-1,3,5,7-butoxy-1-tetrasiloxen-o/-7. (*In Russian.*) Issledovanie v oblasti sinteza i prevrashchenii kislorodsoderzhashchikh kremneorganicheskikh soedinemi. VIII. Sintezi izuchenie svoĭstv nizkomolekuliarnykh efirov metil-α-naftilsilandiola. ***M. F. Shostakovskiĭ and Kh. I. Kondrat'ev.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 6, June, p. 1041-1048.

12613* Synthesis and Properties of Monomethylsubstituted Alkanes of C_{15}-C_{16} Composition. The synthesis of 26 monomethylsubstituted alkanes of C_{15}-C_{16} composition was carried out and their properties described. Regularities of the temperatures of crystallization of these hydrocarbons were determined on the basis of the data obtained. It is supposed that the crystallization of the monomethylsubstituted alkanes proceeds with the formation of structures having the shortest C chain. (*In Russian.*) Sinterz i svoistva monometilzameshchennykh alkanov sostava C_{15}-C_{16}. ***Al. A. Petrov, S. R. Sergienko, N. A. Nechitailo, and A. L. Tsedilima.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 6, June, p. 1091-1097.

12614 Rhenium and Its Compounds as Hydrogenation Catalysts. II. Rhenium Heptaselenide. First recorded application of rhenium heptaselenide as a hydrogenation catalyst in the reduction of a variety of substrates. ***H. Smith Broadbent and Charles W. Whittle.*** *American Chemical Society, Journal,* v. 81, July 20, 1959, p. 3587-3589.

12615 Photoreactions of Metalloörganic Compounds of Mercury. 1,4-Butanediol was obtained in 40% yield when methanol solutions of 2-chloromercuriethanol were exposed to ultraviolet light. ***V. Weinmayr.*** *American Chemical Society, Journal,* v. 81, July 20, 1959, p. 3590-3592.

12616 High Pressure Thermal Alkylation of Monoalkylbenzenes by Butenes. Thermal reactions of toluene, ethylbenzene, and cumene with 1-butene were studied in a flow-type system at 410 atm. pressure and at a temperature of 450 C. ***Herman Pines and C. N. Pillai.*** *American Chemical Society, Journal,* v. 81, July 20, 1959, p. 3629-3633.

12617 The Synthesis of 1-Bromobenzo[c]phenanthrene. Synthesis starting from *o*-bromobenzaldehyde. ***Melvin S. Newman and Donald K. Phillips.*** *American Chemical Society, Journal,* v. 81, July 20, 1959, p. 3667-3670.

12618 Bifurandione. I. Preparation and Characterization. II. Hydrogenation. III. Addition and Ring-Opening Reactions. IV. Polarographic Reduction. I. ***J. C. Sauer, et al.*** II-III. ***H. E. Holmquist, et al.*** IV. ***E. A. Abrahamson.*** *American Chemical Society, Journal,* v. 81, July 20, 1959, p. 3677-3695.

12619 On the Hydrogenation of Purines. The reduction of purine hydrochloride under one atmosphere of H in the presence of Pd-charcoal catalyst at room temperature, and the inertness under the same conditions of purine and the biological purines: adenine, guanine and xanthine are interpreted in terms of the relatively great value of the free valence—and correlatively small value of the radical localization energy—of C-6 of purine hydrochloride. ***T. Nakajima and B. Pullman.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3876-3877.

12620 Pyridoxine and Pyridoxal Analogs. II. Infrared Spectra and Hydrogen Bonding. Infrared spectra of pyridinecarboxaldehydes, *o*-methoxypyridinecarboxaldehydes, and *o*-hydroxypyridinecarboxaldehydes and of the corresponding substituted benzaldehydes are reported for the solid and liquid states and for dilute CCl_4 solutions. Evidence is given that intramolecular H bonding exists in 3-hydroxy-4-pyridinecarboxaldehyde and 3-hydroxy-2-pyridinecarboxaldehyde in the liquid state and in solution, and the strength of chelation is correlated to the bond order in pyridine. ***Dietrich Heinert and Arthur E. Martell.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3933-3943.

12621 Resolutions and an Attempted Partial Asymmetric Synthesis in Papain-Catalyzed Syntheses of Nα, Nβ -Diacylhydrazines From Hydrazides and Acylated Amino Acids. Nα, Nβ -Diacylhydrazines have been prepared successfully from hydrazides and acylated amino acids by papain catalysis. In every reaction where racemic acylated amino acids were employed, resolution occurred. The optimum *p*H for the reaction between benzhydrazide and hippuric acid was about 4. Twenty-six new diacylhydrazines were prepared. In the reaction between DL-mandelic hydrazide and hippuric acid no resolution occurred, but a racemic product resulted. An attempted partial asymmetric synthesis in the reaction between ethylmalonic hydrazide and carbobenzoxyglycine was not successful, but this reaction likewise gave a racemic product. ***John Leo Abernethy,***

Marvin Kientz, Ronald Johnson, and Rodney Johnson. *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3944-3948.

12622 Syntheses of 14,15,16,17-Tetrahydroerythrinane. ***V. Boekelheide, Marcel Müller, J. Jack, T. T. Grossnickle, and M. Chang.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3955-3959.

12623 A Synthesis of 14,15,16,17-Tetrahydro-16-oxaerythrinane and Its Identity With Anhydro-α-hexahydrodesmethoxy-β-erythroidinol. ***M. Müller, T. T. Grossnickle, and V. Boekelheide.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3959-3963.

12624 Synthesis of Potential Anticancer Agents. XIX. 2-Substituted N^6-Alkyladenines. Several 2-substituted N^6-alkyladenines have been prepared from the corresponding 6-(alkylthio)-purines. Debenzylation of the N^6-alkyl-2-(benzylthio)-adenines has been effected by treatment with Na in liquid ammonia. ***John A. Montgomery, Lee B. Holum, and Thomas P. Johnston.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3963-3967.

12625 Potential Anticancer Agents. XIX. Synthesis of 2'-Deoxyadenosine. ***Charles D. Anderson, Leon Goodman, and B. R. Baker.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3967-3975.

12626 S-Adenosylmethionine: The Relation of Configuration at the Sulfonium Center to Enzymatic Reactivity. The sulfonium diastereoisomers of S-adenosyl-L-methionine were resolved enzymatically and their optical rotations determined. It was shown that the methionine activating enzymes of yeast and liver yield products of the same steric configuration and that the steric requirements of guanidinoacetate methylpherase, the S-adenosylmethionine cleaving enzyme of yeast and catechol O-methyl transferase are identical with respect to the sulfonium center. (±)-S-Adenosyl-D-methionine was synthesized by the chemical methylation of S-adenosyl-D-homocysteine and its utilization by guanidino-acetate methylpherase investigated. ***G. De La Haba, G. A. Jamieson, S. Harvey Mudd, and Henry H. Richards.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3975-3980.

12627 Peptide Syntheses *Via* Amino Acid Active Esters. Amino acid active ester hydrobromides were prepared. By use of these compounds, tripeptide derivatives were synthesized in high over-all yield without isolation of a dipeptide intermediate. This was accomplished by taking advantage of the difunctionality of the amino acid active ester as well as the difference in rate of reaction at the amino and active ester ends of the molecule. ***Murray Goodman and Kenneth C. Stueben.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 3980-3983.

12628 The Preparation and Rearrangement of 2-Allyl-1,2-dihydroquinoline. ***Henry Gilman, John Eisch, and Theodore S. Soddy.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4000-4003.

12629 Cyanation of Amine Oxide Salts. A New Synthesis of Cyanopyridines. The addition of cyanide ion to N-alkoxy-quaternary salts of pyridines, quinolines and isoquinoline has been found to yield the corresponding cyano-substituted heterocycles under very mild reaction conditions. The reaction offers a new route to cyanopyridines, and supplements the Reissert and Kaufmann reactions in the quinoline and isoquinoline series. ***Wayne E. Feely and Ellington M. Beavers.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4004-4007.

12630 Cyanocarbon Chemistry. XIII. N-(2,2-Dicyano-1-alkoxyvinyl)-imidoyl Chlorides and Their Reactions. XIV. Formation of a Bicyclo [2.2.0]hexane From Tetracyanoethylene. The amino moiety of 1-amino-1-alkoxy-2,2-dicyanoethylenes has been found to condense with the carbonyl group of aliphatic acid chlorides to give, with the loss of water, N-(2,2-dicyano-1-alkoxyvinyl)-imidoyl chlorides. The imidoyl chlorides easily react with amines and alcohols to form amides and esters of the corresponding imidic acids. Cyclobutane ring formation occurs when tetracyanoethylene reacts with certain dienes, and in one case a bicyclo [2.2.0]hexane has been obtained. XIII. ***H. F. Mower and C. L. Dickinson.*** XIV. ***J. K. Williams.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4011-4015.

12631 Amphenone Analogs. III. Pinacol-Pinacolone Type Rearrangement in the Pyridine Series. The three isomeric acetylpyridines were reduced to the corresponding pinacols which in turn were rearranged. ***W. L. Bencze and M. J. Allen.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4015-4018.

12632 Isotope Effects in the Enzymatic Decarboxylation of Oxalacetic Acid. $HO_2C\text{-}CO\text{-}CH_2\text{-}C^{13}O_2H$ has been prepared and decarboxylated in the presence of metal ions and in the presence of the partially purified enzyme from *Micrococcus lysodeikticus.* The reaction catalyzed by Mn^{++} at 10 C showed an isotope effect, k^{12}/k^{13}, of nearly 1.06, whereas the ratio for the enzymatic reaction was 1.00. Further, the enzymatic decarboxylation proceeds less rapidly in D_2O than in H_2O, whereas the rate for the metal ion-promoted reaction is unaffected by this change in solvent. ***Stanley Seltzer, Gordon A. Hamilton, and F. H. Westheimer.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4018-4024.

12633 The Association of Divalent Cations With Glutathione. Glutathione may combine with metallic ions, at two loci; either like an α-amino acid, by chelation through the amino and carboxylate groups of the glutamyl residue, or through binding at the cysteinyl S. The interactions of several divalent metallic ions with glutathione and S-methylglutathione have been determined by titration. Since the S atom is blocked in the S-methyl derivative, comparison of the data permits estimation of the relative importance of binding at the two loci in glutathione. For divalent Zn, Ni, Co, and Mn, it is estimated that 80, 10, 30, and 15%, respectively, of the bound metallic ion is attached at the S atom. ***R. Bruce Martin and John T. Edsall.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4044-4047.

12634 On the Effect of Dose Rate on the Radiolysis of Liquid Hydrocarbons. Dose rate dependence of secondary reactions in the radiolysis of cyclopentane-cyclohexane mixtures by Co-60 γ rays. ***Robert H. Schuler and G. A. Muccini.*** *American Chemical Society, Journal,* v. 81, Aug. 5, 1959, p. 4115-4116.

12635* Ultraviolet Irradiation of Pyrimidine Derivatives. III. Influence of Hydrogen Cyanide on the Photolysis. ***A. M. Moore.*** *Canadian Journal of Chemistry,* v. 37, Aug. 1959, p. 1281-1287.

12636* Preparation of Chloropolysilane From the Copper-Catalyzed Reaction of Silicon Metal and Hydrogen Chloride. Copper catalyzed reaction of Si metal powder with HCl by flow method was studied in order to find a convenient synthesis for chloropolysilane, and also to elucidate the mechanism of this reaction. ***Isao Shihara and Jun Iyoda.*** *Chemical Society of Japan, Bulletin,* v. 32, no. 6, June 1959, p. 636-645.

12637 Surface Activity of Organo-Silicon Compounds. A review of the surface activity of silicones. Some aspects of the structure of these polymers in relation to their surface properties. ***R. L. Bass.*** *Chemistry & Industry,* 1959, no. 29, July 18, p. 913-918.

12638 *Cyclo*octatetraene-Iron Tricarbonyl and *Cyclo*octatetraene-Diiron Hexacarbonyl. Reactions of this unsaturated hydrocarbon with metal carbonyls. ***M. D. Rausch and G. N. Schrauzer.*** *Chemistry & Industry,* 1959, no. 30, July 25, p. 957-958.

12639* On Steroids. XXXVII. Preparation of Methyl 3β,16α-Diacetoxybisnor*allo*cholanate and Its 20-Epimer. A Novel Synthesis of the Side Chain of Steroidal Bisnor-Acids. ***V. Schwarz, V. Černý, and F. Sorm.*** *Collection of Czechoslovak Chemical Communications,* v. 24, no. 6, June 1959, p. 1851-1859.

12640* Epoxidation of the Higher Unsaturated Fatty Acid Esters. A study of the effect of reaction conditions on epoxidation of esters of higher unsaturated fatty acids by means of aliphatic peracids produced directly in the reaction mixture of H_2O_2 and of the corresponding organic acid. Conditions for maximum yields of epoxy compounds. (*In German.*) Epoxydier-

ung der höheren ungesättigten Fettsäureester. ***J. Dvořák.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 6, June 1959, p. 1975-1981.

12641* Amino-Acids and Peptides. XXV. Dehydration of Derivatives of Asparagine and Glutamine; A New Route to α,γ-Diaminobutyric Acid, Ornithine, and Arginine. XXVI. An Improved Synthesis of L-Glutamine. XXV. ***M. Zaoral and J. Rudinger.*** XXVI. ***J. Rudinger, K. Poduška, M. Zaoral, and K. Jošt.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 6, June 1959, p. 1993-2017.

12642* Reaction of d-Sabinol With Selenium(IV) Oxide. A study of the $C_{20}H_{28}O_2$ compound, produced by means of the oxidation of sabinol with selenium(IV) oxide in ethyl alcohol. (*In Russian.*) Vzaimodeĭstvie *d*-sabinola s dvuokisʹiu selena. ***F. Petru and Ia. Kovarzh.*** *Collection of Czechoslovak Chemical Communications*, v. 24, no. 6, June 1959, p. 2079-2082.

12643* Syntheses and Infrared Absorption Spectra of Some Alkylgermanium Di- and Trihydrides. Reduction by means of $LiAlH_4$ of $RGeX_2$ and R_2GeX_2 leads to the corresponding $RGeH_3$ and R_2GeH_2. The vibration with valence Ge-H occurs between 2000 and 2100 cm^{-1}. (*In French.*) Synthèses et spectres d'absorption infrarouge de quelques di- et trihydrures d'alcoylgermanium. ***Jacques Satgé, Raymonde Mathis-Noël, and Michel Lesbre.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 1, July 6, 1959, p. 131-133.

12644* Interesterification in Fats. III. Influence of Various Catalysts on Interesterification of Unsaturated Fatty Acid Esters. Methyloleate, triolein, and soybean oil have been interesterified under various experimental conditions. No cis-trans-isomerization has been detected within the limiting range of sensitivity of the testing method employed. Practically no conjugation takes place. Polymerization has been observed to enter the reaction only at higher temperatures (above 150 C). Mono- and diglycerides however arise in small quantities. Emphasis is laid on the careful analytical testing of the interesterified fats. (*In German.*) Umesterungen auf dem Fettgebiet. III. Über den Einfluss verschiedener Umesterungskatalysatoren auf ungesättigte Fettsäuren. ***H. P. Kaufmann and B. Grothues.*** *Fette, Seifen, Anstrichmittel*, v. 61, June 1959, p. 425-429.

12645* Preparation and Characterization of a Fully Iodinated Insulin Derivative. ***Lise Gruen, Michael Laskowski, Jr., and Harold A. Scheraga.*** *Journal of Biological Chemistry*, v. 234, no. 8, Aug. 1959, p. 2050-2053.

12646 Hydroboration of Fats. I. Positional Isomerism in the Methyl Oleate Hydroboration Reaction. Addition of diborane to the ethylenic bond of methyl oleate proceeds smoothly without significant reduction of the carbomethoxy group. Alkaline hydrogen peroxide oxidation of the tris(carbomethoxyalkyl)borane resulted in the formation of an equimolar mixture of 9- and 10-hydroxyoctadecanoic acids, establishing that the hydroboration reaction proceeded nonselectively. ***Sara P. Fore and W. G. Bickford.*** *Journal of Organic Chemistry*, v. 24, July 1959, p. 920-922.

12647 Substituted Styrenes. V. Reaction of Styrene and α-Methylstyrene With Dihalocarbenes. Dichloro- and dibromocarbene were allowed to react with styrene and α-methylstyrene, and the products were reduced to phenylcyclopropanes by Na and methanol. ***Wesley J. Dale and Paul E. Swartzentruber.*** *Journal of Organic Chemistry*, v. 24, July 1959, p. 955-957.

12648 Synthesis of Diarylphosphine Oxides by the Friedel-Crafts Method. The reaction of mesitylene, durene, or pentamethylbenzene with PCl_3 and $AlCl_3$ catalyst under conditions normally employed for the synthesis of primary phosphonous dichlorides gave instead good yields of secondary phosphine oxides (after hydrolysis). Small amounts of secondary phosphinic acids were obtained as by-products. ***Arlen W. Frank.*** *Journal of Organic Chemistry*, v. 24, July 1959, p. 966-968.

12649 Chemistry of Merimines. II. Reductive Alkylation. Excellent yields of tertiary amines were obtained when 2-unsubstituted merimine derivatives were reductively alkylated with either aldehydes or ketones. ***William B. Wright, Jr.*** *Journal of Organic Chemistry*, v. 24, July 1959, p. 1016-1018.

12650* The Chlorination of 4-Aminobenzoic Acid and Its Methyl Ester. ***C. Van Der Stelt and W. Th. Nauta.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, July 1959, p. 534-542.

12651* The Reaction of Alkylmagnesium Halides With Thiophosphoryl Chloride. II. Formaton of Dialkylphosphinic Chlorides. ***P. J. Christen and L. M. Van Der Linde.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, July 1959, p. 543-550.

12652* Chemistry of Acetylenic Ethers. XXXVII. Synthesis of β-lactams (2-azetidinones) From Imines and Ethoxyalkynes. ***A. M. Van Leusen and J. F. Arens.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, July 1959, p. 551-557.

12653* On the Sulphonation of Pyridine-N-Oxide. Sulphonation with fuming H_2SO_4 and $HgSO_4$ as a catalyst yields, together with the 3-sulfonic acid as a chief product, the 2- and 4-isomers. ***M. Van Ammers and H. J. Den Hertog.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 78, July 1959, p. 586-588.

12654 Steroids. This book replaces the well respected *Natural Products Related to Phenanthrene*, 3rd edition (1949). It is a completely revised account of the whole expansive field written from the perspective of modern theory. Organization of the material of each chapter into a series of related topics unifies the discussion of the early history and the ensuing developments. ***Louis F. Fieser and Mary Fieser.*** 945 pp. 1959. Reinhold Publishing Corp., New York. (QD415 F46s)

12655 Synthetic Methods of Organic Chemistry. New methods for the synthesis of organic compounds, improvements of known methods, and also old proved methods scattered in periodicals, are being recorded continuously in this book series. ***W. Theilheimer.*** v. XIII, 600 pp. 1959. S. Karger, New York. (QD262 T34str Vis.)

12656* Selective Reactions and Modification of Functional Groups in Steroid Chemistry. Reviews selective reactions on multifunctional compounds, and protection of one type of functional group against the consequence of reactions aimed at another. ***H. J. E. Loewenthal.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 269-303.

12657* Anhydrobiisatic Acid. 6:12-OXA-5:6:11:12-Tetrahydrophenhomazine-6:12-Dicarboxylic Acid. This new type of compound containing the phenhomazine ring system was obtained by self-condensation of isatic acid—(*o*-aminophenyl) glyoxylic acid—. The structure of this acid was established and derivatives prepared. N;N′-Dimethylanhydrobiisatic acid was resolved into optically active components. ***Gj. Stefanović, Lj. Lorenc, R. I. Mamuzić, and M. Lj. Mihailović.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 304-311.

12658* Constitution of Pinastric Acid. New observations based on a study of its reactions with *o*-phenylene diamine, dimethylaniline, and oxidation with $NaIO_4$. ***P. K. Grover and T. R. Seshadri.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 312-314.

12659* Heterocyclic Fluorine Compounds. III. Monofluoroxanthones. The four monofluoroxanthones substituted in the benzene ring were prepared by two different routes, namely by cyclization of the appropriate carboxyfluorodiphenyl ether and by a Balz-Schiemann reaction with the corresponding aminoxanthone. ***F. L. Allen, P. Koch, and H. Suschitzky.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 315-318.

12660* Stereochemistry of the Reduction of Tropinone. ***A. H. Beckett, N. J. Harper, A. D. J. Balon, and T. H. E. Watts.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 319-330.

12661* Anthraquinone and Anthrone Series. XXIII. The Non-Identity of 1:3:8-Trihydroxy-2-Hydroxymethylanthraquinone With Versicolorin and a Synthesis of Damnacanthol and Damnacanthal. ***N. R. Ayyangar, B. S. Joshi, and K. Venkataraman.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 331-337.

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12662* The Kinetics of the Reaction Between Hydrogen and Oxygen on Platinum. For mixtures containing an excess of H_2, the first order on O_2 and the weak effect of the H_2 pressure on the velocity of the reaction suggests that the interaction between the hemisorbed atomic H, covering the whole surface, and the molecular O is the limiting stage of the reaction. The character of the transition between the processes of a rapid and slow course of the reaction suggests that the rapid reaction is in connection with the chain process. (*In Russian.*) Kinetika reaktsii vzaimodeistviia vodoroda s kislorodom na platine. ***E. N. Khar'kovskaia, G. K. Boreskov, and M. G. Slin'ko.*** *Akademiia Nauk SSSR, Doklady*, v. 127, no. 1, July-Aug. 1959, p. 145-148.

12663 Kinetic Study of Aromatic Nucleophilic Substitution Under High Pressure. II. Variation of Solvent and Reactant Charge Type. Volume changes of activation for the reactions of several bromoquinolines and bromonaphthalenes with pure piperidine, piperidine in water, piperidine in cyclohexane, and alkoxides in alkanol were measured. ***K. R. Brower.*** *American Chemical Society, Journal*, v. 81, July 20, 1959, p. 3504-3507.

12664 Ammonia-Triborane. The Heat Capacity, Heat of Transition and Thermodynamic Properties From 5 to 317°K. ***Edgar F. Westrum, Jr. and Norman E. Levitin.*** *American Chemical Society, Journal*, v. 81, July 20, 1959, p. 3544-3547.

12665 Systematics in the Chemistry of the Boron Hydrides. Four types of chemical reactions of B hydrides are recognized. The type of reaction expected from a given molecule is related to the position of the molecule in a systematic arrangement and to the geometry of the original B hydride. ***R. W. Parry and L. J. Edwards.*** *American Chemical Society, Journal*, v. 81, July 20, 1959, p. 3554-3560.

12666 Mechanism of Racemization of Complex Ions. V. The Dissociation and Racemization of Tris-(2,2′-bipyridine)-iron(II) and Tris-(1,10-phenanthroline)-iron(II) Ions in Water-Methanol and Methanol Solutions. ***Lester Seiden, Fred Basolo, and H. M. Neumann.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3809-3813.

12667 The Effect of Coordination on Electron Withdrawal. The electron withdrawing power of a group III metal is found to decrease when it is coordinated with diethyl ether. It is also confirmed that Ga has a greater electronegativity than Al. ***S. Brownstein, B. C. Smith, G. Ehrlich, and A. W. Laubengayer.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3826-3828.

12668 Interaction of Tetraisopropyl Titanate and Monoethylamine in *n*-Decane Solution. Studies at 25 and 35 C in *n*-decane solution show interaction to be weaker than previously-reported ones between amines and Ti chlorides. ***Charles M. Cook, Jr.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3828-3830.

12669 Electric Moments of VCl_4 and $VOCl_3$. The electric moments of $VOCl_3$ and VCl_4 have been estimated from solution measurements in CCl_4 at 25 C. VCl_4 appears to have zero moment and $VOCl_3$ a small moment, calculated to be about 0.3 debye unit. At 25 C the dielectric constant of VCl_4 is 3.11 and the dielectric constant of $VOCl_3$ is 2.90. The index of refraction of $VOCl_3$ at 27 C. for the sodium-*D* line, is 1.630. ***Charles N. Caughlan and Fred Cartan.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3840-3841.

12670 Preparation of the Ferrites $BaFe_{12}O_{19}$ and $SrFe_{12}O_{19}$ in Transparent Form. These ferrites were prepared by the interaction of ferric oxide and the corresponding alkaline earth fluoride or chloride under O. The crystals obtained by this technique are small transparent platelets, up to 1 mm in diameter and approximately 50 μ thick, which are essentially free of strain, thus permitting directly the observation and study of the internal magnetic domain structure by transmitted polarized light without delicate grinding and polishing procedures. ***Lothar H. Brixner.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3841-3843.

12671 A Magnetic Investigation on Supported Molybdenum Dioxide. The magnetic susceptibilities of a series of precipitated molybdenum oxide-alumina preparations have been measured in a H atmosphere after H reduction at 440-450 C. Crystalline MoO_2 shows a temperature independent susceptibility of $+0.33 \times 10^{-6}$ per gram. By dilution of the molybdenum oxide on the alumina support, the susceptibility of MoO_2 increases considerably. ***Erling Rost.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3843-3845.

12672 Hydrogen Halides in Acetonitrile. I. Ionization Processes. II. Solid Substrates. III. Electrical Conductance. ***George J. Janz and Steven S. Danyluk.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3846-3858.

12673 The Photolysis and Fluorescence of Acetone and Acetone-Biacetyl Mixtures. ***Julian Heicklen and W. Albert Noyes, Jr.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3858-3863.

12674 The Fluorescence and Phosphorescence of Biacetyl Vapor and Acetone Vapor. Studies at 40° as a function of pressure and incident wave length from 4358 to 3020 Å. A mechanism is proposed which explains both the light emission and the photochemistry. ***Julian Heicklen.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3863-3866.

12675 Radiolysis of CH_3COOCH_3 and CH_3COOCD_3 by Cobalt-60 γ-Rays. Yields of the volatile radiation decomposition products were studied as a function of temperature, dose, and the presence of added radical scavengers. ***P. Ausloos and C. N. Trumbore.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3866-3871.

12676 Factors Affecting the Non-Newtonian Viscosity of Rigid Particles. The viscosities of two poly-γ-benzyl-L-glutamate samples and a mixture of them were measured as a function of shearing stress τ (up to 10^5 dynes cm.$^{-2}$ in *m*-cresol in which the polypeptides exist as rod-like α-helices. Marked reduction in intrinsic viscosity (η) (to less than 5% of its value at $\tau = 0$ for the high molecular weight sample) can be achieved at the highest attainable τ. ***Jen Tsi Yang.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3902-3907.

12677 The Structure of the Cyclic Tetramer of Dimethylgallium Hydroxide. ***Gordon S. Smith and J. L. Hoard.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3907-3910.

12678 Multilayer Membrane Electrodes. II. Preparation and Use in Double Concentration Cells. Multilayers of the alkaline earth salts of stearic, hexadecyl-, and octadecylsulfuric and hexadecylorthophosphoric acids were prepared on two halves of a previously cracked glass slide; these were then cemented together to form a multilayer membrane electrode, such that alkaline earth cations could diffuse through the membrane from one contiguous solution phase to another in a direction *normal* to the axis of orientation of the long-chain acids. The electrodes had ohmic resistances ranging from 20 to 60×10^6 ohms for a given area (2 cm. x 2500 Å.), possessing a specific resistance of 2×10^4 ohm-cm. ***Harry P. Gregor and Harold Schonhorn.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3911-3915.

12679 Correlations Between Solvent Structure, Viscosity and Polarographic Diffusion Coefficients of Oxygen. ***Joseph Jordan and William E. Bauer.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3915-3919.

12680 Polarographic Behavior of Some 1,4-Substituted-2,3,5-pyrrolidinetriones. A parallelism has been found between their behavior and the behavior of such compounds as pyruvic acid and phenylglyoxylic acid which can exist in both anion and undissociated forms, both of which are reducible. Application of theory derived by Delahay has given rates of recombination of the order of 10^8 to 10^{11} 1. mole^{-1} sec^{-1}. ***E. A. Abrahamson.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 3919-3922.

12681* Adsorption of Sterically Hindered Phenols on Carbon. Freundlich isotherms for the adsorption of some ortho-alkylated phenols on C from cyclohexane solution have been determined. ***Owen H. Wheeler and Eric M. Levy.*** *Canadian Journal of Chemistry*, v. 37, Aug. 1959, p. 1235-1240.

12682* Particle Size Distributions in Ultrasonic Emulsification. Studies to correlate the particle sizes in emulsions prepared by ultrasonic irradiation and by hand-shaking, and to investigate the effect of increasing the time of irradiation of the emulsion. ***E. S. Rajagopal.*** *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 6, June 1959, p. 333-339.

12683* The Crystal Structures of L-Tyrosine Hydrohalides. I. L-Tyrosine Hydrobromide. *R. Srinivasan.* *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 6, June 1959, p. 340-373.

12684 A Reaction Mechanism for the Hydrogenation of Carbon Monoxide Including a Reversible Catalyst Reaction. A reaction mechanism is proposed to account for observed effects of pressure, temperature and H to CO ratio on the rate of hydrogenation of CO in a differential reactor. The mechanism includes a reversible catalyst reaction and parallel, irreversible hydrogenation reactions. Equations based on this mechanism represent the data satisfactorily. Activation energies are calculated for both the catalyst reactions and hydrogenation reactions. ***John E. Powers.*** *Journal of Physical Chemistry*, v. 63, Aug. 19, 1959, p. 1219-1223.

12685 Studies on the Anodic and Cathodic Polarization of Amalgams. II. Mercury in Ammonium Hydroxide Solutions. III. Passivation of Zinc Amalgam in Alkaline Solutions. *A. M. Shams El Din, S. E. Khalafalla, and Y. A. El-Tantawy.* *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1224-1227 and 1252-1255.

12686 The Electronegativity of Groups. The electronegativity relationships presented in a previous paper have been consolidated and regularized to give the general relationship for all covalent substances $MX_n(S)$ yielding ions in water solution, $pK_{sp}/(1 + n) = 14.8 - 8.5\ \Delta x$, where n is 1 to 4, X is any uninegative group and Δx is the difference in electronegativity between M and X. Likewise, for dinegative groups in M_mX_n, the relationship is $pK_{sp}/(m + n) = 48.7 - 37.5\ \Delta x$. ***A. F. Clifford.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1227-1231.

12687 The Rates of the Electron Exchange Reaction Between U (IV) and U (VI) Iosn in Water, Ethanol and Water-Ethanol Solvents. The rate of the electron exchange reaction between U(IV) and U(VI) ions was studied at 25 C in water, ethanol, and water-ethanol solvents and at various concentrations of U(IV), U(VI) and HCl. The order of the reaction with respect to each of these substances was found to depend strongly on the composition of the solvent. Mechanistic and kinetic expressions are suggested which can account for these orders in solvents up to 60 vol. % ethanol. ***Daniel M. Mathews, Jack D. Hefley, and Edward S. Amis.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1236-1240.

12688 Relation of Wettability by Aqueous Solutions to the Surface Constitution of Low-Energy Solids. Contact angles of a variety of pure anionic, cationic, and non-ionic surface-active agents in aqueous solutions of various concentrations were measured on smooth, clean surfaces of two low-energy solids, polyethylene and Teflon. Wettability curves were obtained for each solid surface by plotting the cosine of the contact angle *versus* the surface tension of each solution. ***M. K. Bernett and W. A. Zisman.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1241-1246.

12689 A Thermodynamic Study of Some Coördination Complexes of Metal Ions With Diprotic Nitrogen Compounds Containing One Heterocyclic Nitrogen Atom. Formation constants were determined for 2-picolylamine, 2-picolylmethylamine, and 2-(2-aminoethyl)-pyridine with Cu, Ni, Co(II), Zn, and Cd ions over the temperature range 10-40 C. Formation constants for Fe(II) were determined at 30 C with 2-picolylamine and 2-picolylmethylamine, but formation constants were unobtainable for Ag with any of the amines listed. ***David E. Goldberg and W. Conrad Fernelius.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1246-1249.

12690 The Sorption of Hydrocarbon Vapors by Silica Gel. The sorption isotherms of a series of liquid and gaseous hydrocarbons on a standard silica gel have been determined, mainly at 25 C. Measurements also have been made with nitromethane, nitroethane, and CCl_4 for comparison purposes. ***Douglas W. McKee.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1256-1259.

12691 The Thermodynamics of Dilute Solutions of $AgNO_3$ and KCl in Molten KNO_3, From Electromotive Force Measurements. I. Experimental. II. A Quasi-Lattice Model. Measurements of the activities of $AgNO_3$ were made in a fused salt concentration cell at 370 and 436 C in dilute solutions of Ag^+ and Cl^- ions. The activities of $AgNO_3$ obeyed the Nernst law at the low concentrations of $AgNO_3$ measured when no Cl^- ions were present. I. ***Milton Blander, F. F. Blankenship, and R. F. Newton.*** II. ***Milton Blander.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959. p. 1259-1265.

12692 Phase Equilibria in the Fused Salt Systems LiF-ThF_4 and NaF-ThF_4. *R. E. Thoma, H. Insley, B. S. Landau, H. A. Friedman, and W. R. Grimes.* *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1266-1274.

12693 Salt Effects in the Racemization of a Biphenyl Having a Cationic Barrier Group. The racemization of *d-o*-(2-dimethylaminophenyl)-phenyltrimethylammonium ion is accelerated by added salts. The largest acceleration is a factor of 2.46. The activation enthalpy is in most cases decreased by salts, sometimes by almost 3 kcal./mole. The activation entropy is also decreased as much as 6 cal./mole degree. ***W. H. Graham and J. E. Leffler.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1274-1278.

12694 The Crystal and Molecular Structure of Triammino-Chromium Tetroxide. The compound is composed of discrete monomeric molecules which may crystallize in more than one form. A monoclinic form was investigated and found to belong in space group C_{2h}^5-$P2_1/c$. ***E. H. McLaren and Lindsay Helmholz.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1279-1283.

12695 The Diffusion Coefficient of Lactamide in Dilute Aqueous Solutions at 25° as Measured With the Gouy Diffusiometer. The diffusion coefficient D and the specific refractive index increment $\Delta n/\Delta c$ have been determined as functions of concentration for aqueous solutions of lactamide over the range 0.5 to 17.8 g./100 ml. These data are compared with corresponding data from the literature for the system α-alanine-water, and the concepts of dipole-dipole interaction and electrostriction are used to interpret the differences. ***Richard P. Wendt and Louis J. Gosting.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1287-1291.

12696 The Sorptive Properties of a Zeolite Containing a Preadsorbed Phase. When a degassed zeolitic substrate is saturated with respect to a given sorbate, not even the largest channels or pores are necessarily physically filled. By examining the adsorption of a second sorbate on a zeolite already saturated with respect to another vapor, information may be gained as to the positions of molecules in the preadsorbed layer with respect to the substrate structure. Even a non-dipolar species such as CCl_2F_2 appears to form clusters around the charge-compensating cations, comparable with the "hydration sheaths" of coordinated water suggested by others to explain the diffusion of water in zeolitic channels. ***Peter Cannon and Cecelia P. Rutkowski.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1292-1296.

12697 The Molecular Configuration of Erucic and *cis*-Nervonic Acids in the Crystal Structures. The general features of the crystal structures of erucic and *cis*-nervonic acids, two *cis*-ethylenic long chain fatty acids are deduced from the similarity of the single crystal X-ray diffraction patterns with that of *cis*-DL(11-12)-methyleneoctadecanoic acid, a typical *cis*-cyclopropyl long chain fatty acid, whose crystal structure has previously been established. It is concluded that the *cis*-ethylenic molecules are bent at the double bond so that the over-all configuration, as in the *cis*-cyclopropyl acids, is like that of a boomerang. ***B. M. Craven.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1296-1298.

12698 The Thermodynamic Properties of the System: Hydrochloric Acid, Sodium Chloride and Water From 0 to 50°. *Herbert S. Harned.* *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1299-1302.

12699 Vapor-Liquid Equilibrium for the Diborane-Ethyl Ether System. Studies were made at 25, 50, and 100 p.s.i. It is shown that the equilibrium diagram for the system can be calculated from the properties of the pure components. ***George E. MacWood and Leo J. Paridon.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1302-1304.

12700 The Thermal Decomposition of 2-Nitropropane. The vapor phase pyrolysis of 2-nitropropane has been studied at temperatures ranging from 250 to 337 C and has been shown to follow first-order kinetics over this range. Complete product analyses were made mass spectrometrically. The major decomposition products were propylene, nitric oxide, and water. The most abundant minor ones were acetone, acetonitrile, and formaldehyde. ***Trudy Enzer Smith and Jack G. Calvert.*** *Journal of Physical Chemistry*, v. 63, Aug. 1959, p. 1305-1309.

12701* The Physico-Chemical Behaviour of Perfume Materials in Various Carriers. ***J. Stephan Jellinek.*** *Perfumery and Essential Oil Record*, v. 50, July 1959, p. 593-598.

12702* A High-Resolution Study and Analysis of the ν_2 NH_3 Vibration-Rotation Band. Infra-red absorption band of ammonia were recorded under a resolution of 0·1 cm^{-1} and the molecular constants were derived. ***H. M. Mould, W. C. Price, and G. R. Wilkinson.*** *Spectrochimica Acta*, 1959, no. 5, June, p. 313-330.

12703* Stereochemistry of the Primary Carbon. X. Stereochemical Configurations of Some Optically Active Deuterium Compounds. The *iso*bornyloxymagnesium halide reduction of the appropriate deutero-aldehyde yields benzyl-α-*d* alcohol and 1-butanol-1-*d* having the same configuration and about the same level of optical purity. Arguments are presented that these alcohols are close to optical purity. The relative configurations of each alcohol were established by converting each to 1-phenylbutane-1-*d* using reactions of known or presumed stereochemistry. The rotations and configurations of 18 optically active deuterium compounds are summarized. ***A. Streitwieser, Jr., J. R. Wolfe, Jr., and W. D. Schaeffer.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 338-344.

12704* Asymmetric Annellation Effects. II. The comparison of the U.V. absorption spectra of acenes, 1:2-3:4-dibenzacenes and tetrabenzacenes shows a strong asymmetric annellation effect. This is explained on the basic assumption that an aromatic sextet or benzenoid ring can transfer only two electrons to another ring. Three benzenoid rings can thus produce an induced aromatic sextet in an included ring of the type of the central ring in triphenylene. The synthesis of tetrabenzotetracene is described. ***E. Clar.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 355-357.

12705* Asymmetric and Symmetric Annellation Effects. III. Benzocoronenes. 1:2-5:6-Dibenzocoronene was obtained from 1:2-4:5-8:9-tribenzopyrene via the dianhydride. 1:2-4:5-Dibenzopyrene condensed twice with maleic anhydride. The resulting dianhydride gave 1:2-benzocoronene on decarboxylation. 1:12-*o*-Phenyleneperylene was obtained by a Zn dust melt from the quinone. The annellation effects passing from triphenylene and perylene to the benzocoronenes indicate the presence of a triphenylene complex within the electronic fine structure of coronene. ***E. Clar, C. T. Ironside, and M. Zander.*** *Tetrahedron*, v. 6, no. 4, June 1959, p. 358-363.

12706 Phase Relationships in Mixtures of the Simple Polyphenyls and Condensed Ring Aromatics—A Survey of Organic Reactor Coolant Mixtures. ***V. H. Troutner.*** *U. S. Atomic Energy Commission, HW-57431*, Aug. 27, 1958, 77 pp. (UF767 Un3.1hw Contin.)

12707 Zirconium Fluoride Phase Studies. I. A Preliminary Investigation of Solid Phases. ***A. G. Chapman and R. A. Woodriff.*** *U. S. Atomic Energy Commission, IDO-14469*, June 10, 1959, 19 pp. (UF767 Un3.1id Contin.)

12708* On Heterochain Polyamides. XIV. Amorphous Structures of Polyamides. XV. Polyamides of Hydroaromatic Acids. Relation between the structure of mixed linear polyamides and their capacity for forming amorphous structures on quick cooling quenching of a polymer melt at temperatures ranging from −70 to 70 C. Polyamides obtained from the salts of hexamethylenediamine and the cis- and trans-isomers of hexahydrophthalic, hexahydroisophthalic, and hexahydroterephthalic acids were investigated. (*In Russian.*) Iz oblasti geterotsepnykh poliamidov. XIV. Ob amorfnykh strukturakh u poliamidov. ***T. M. Frunze, V. V. Korshak, and V. A. Makarkin.*** XV. Poliamidy gidroaromaticheskikh kislot. ***T. M. Frunze, V. V. Korshak, and V. F. Petrova.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 3, Mar. 1959, p. 342-356.

COATINGS

12709 Vacuum Metallizing Scores Automotive Gains. Description and potentialities of new vacuum metallizing or vacuum coating process. ***Andrew W. Shearer.*** *Automotive Industries*, v. 121, no. 3, Aug. 1, 1959, p. 46 + 4 pages.

12710 How Kawneer Increased Production Efficiency 50%. The production of Zourite porcelain enameled Al is reviewed. ***Clayton O. Stevens.*** *Ceramic Industry*, v. 73, Aug. 1959, p. 54 + 2 pages.

12711 Primer Penetrates Rusty Surfaces. A new phenolic resin wetting agent. *Chemical Processing*, v. 22, Aug. 1959, p. 93-94.

12712* Three Decades of Progress in Electrical Insulation. The better understanding of dielectric phenomena, the development of new synthetic materials, the better understanding of thermally rating insulating materials, and the advance in equipment design are discussed. ***L. J. Berberich.*** *Communication and Electronics*, 1959, no. 43, July, p. 237-248.

12713* Anchor Pattern Profile and Its Effect on Paint Performance. Effects of various cleaning techniques on surface roughness were measured. Height of the anchor pattern profile has a limited effect upon corrosion protection afforded by paints in atmospheric exposure. ***Joseph Bigos.*** *Corrosion*, v. 15, Aug. 1959, p. 46-50.

12714 Hot Organic Coatings. Constitution, applications, and properties of coatings such as asphalt, coal tar pitch, petroleum waxes and cellulose derivatives are presented. Formulations are included. ***Raymond B. Seymour.*** 233 pp. 1959. Reinhold Publishing Corporation, New York. (TP935 Se96h)

12715 Basic Lead Silicochromate Anticorrosive Pigment. Pigment is used in metal-protective coatings or anticorrosive paints. ***A. J. Eickhoff and A. R. Pitrot.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 57A-58A.

12716 Selection and Application of Container Linings. Properties and applications of coating materials for food and beverage products. ***C. Raymond Syer.*** *Industrial Finishing*, v. 35, no. 10, Aug. 1959, p. 39 + 4 pages.

12717* Enamelling of Aluminium. A discussion. ***Ken Jones.*** *Industrial Finishing (London)*, v. 11, July 1959, p. 14-15.

12718* Protection With Cold Galvanising. Claims performance equal to hot galvanizing in marine environments with only one coat. *Industrial Finishing (London)*, v. 11, July 1959, p. 16 + 1 p.

12719 Properties and Application Features of New Heat Fusible Teflon Tape for Wire and Other Uses. ***Saul Ricklin.*** *Insulation*, v. 5, Aug. 1959, p. 40-41.

12720 Plate Life Into Your Dies. Based on a thermally bonded Ni or W plate. *Iron Age*, v. 184, no. 9, Aug. 27, 1959, p. 86-88.

12721* On the Coagulation of Polymer Latices by Freezing and Thawing. ***W. G. Barb and W. Mikucki.*** *Journal of Polymer Science*, v. 37, June 1959, p. 499-514.

12722 A Continuous Line for Coating, Embossing and Decorating Vinyl on Metal. New 400-foot line automatically turns out finished vinyl on metal sheet up to 62 inches wide. *Metal Products Manufacturing*, v. 16, Aug. 1959, p. 40 + 2 pages.

12723* New Developments in High Temperature Ceramic Coatings. ***Frederick D. Shaw.*** *Metal Treating*, v. 10, no. 4, July-Aug. 1959, p. 2 + 3 pages.

12724 Market Trends for Mineral Fillers in Western States. ***Waldemar F. Dietrich.*** *Mining Engineering*, v. 11, Aug. 1959, p. 813-817.

12725* The Effect of Pigments on the Rate of Deterioration of Paint Films. By measuring and comparing differences in rates of deterioration of clear and pigmented coatings, investigators sought a quantitative measure of protection afforded binders by specific pigments. Systems studied were long-oil alkyd, acrylic-resin solution, and polyvinyl acetate solution. Results show little difference in rate of deterioration. ***Prisco Rosa and Adolf C. Elm.*** *Official Digest*, v. 31, Aug. 1959, pt. 1, p. 1075-1085.

12726* Vinyl Dispersions for Product Finishes. Reviews plastisols and organosols as they are used in finishing. ***James C. Fryman.*** *Official Digest*, v. 31, Aug. 1959, pt. 1, p. 1086-1094.

12727* Sporicidal Surface Coatings. Self-sterilizing coatings were prepared by incorporating a formaldehyde polymer such as paraformaldehyde in the coating. The activity of coatings containing paraformaldehyde is presumably due to formaldehyde vapor liberated from its polymer. ***Robert K. Hoffman, Saul Kaye, and Charles E. Feazel.*** *Official Digest*, v. 31, Aug. 1959, pt. 1, p. 1095-1106.

12728* Fluorescent High Visibility Paints for Aircraft. Discusses the essential characteristics of daylight fluorescent paints for use on aircraft. ***Jack S. Cowling and Frank M. Noonan.*** *Official Digest*, v. 31, Aug. 1959, pt. 2, 19 pp.

12729* Flotation in Paints—A Suggested Mechanism. Shows the apparent complexity of this subject and indicates the relative importance of the variables involved. Flotation and flooding are interfacial phenomena and may owe their differences to the nature of the solvent evaporation within the systems in which they are present. ***I. Ferguson.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Aug. 1959, p. 529-542.

12730* The Measurement of the Flexibility of Polyvinyl Acetate Emulsion Films. Describes a method for comparing the flexibilities of films cast from polyvinyl acetate and vinyl acetate copolymer emulsions. ***P. C. Edbrooke, F. P. Grimshaw, and R. A. W. Pateman.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Aug. 1959, p. 543-547.

12731* More About Particle Size and Paint Manufacture. Laboratory trials have shown that very rapid dispersion, at least to ordinary gloss paint standards, can be effected with Micronized and similar pigments in dispersion-type mills in 4 to 20 minutes. Suggests using wetting power of the solvent and so work at low resin solids solutions. ***W. G. Wade.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Aug. 1959, p. 548-556.

12732* Weather Resistant Polyvinyl Alcohol Coatings. Using water as the principal solvent, the coatings are formulated to form acetals that resist solution. The effect of various ingredients on the coating properties are presented. ***Karl F. Plitt.*** *Paint and Varnish Production*, v. 49, no. 9, Aug. 1959, p. 27 + 4 pages.

12733* Isophthalic Alkyds in Coatings. Isophthalic modified oils are being used as house paint vehicles. The finish system shows faster drying, better gloss and color retention, and improved durability. ***R. Burkel.*** *Paint and Varnish Production*, v. 49, no. 9, Aug. 1959, p. 32 + 3 pages.

12734* Determination of the Modulus of Elasticity in the Study of Paint Films. ***H. Van Hoorn and P. Bruin.*** *Paint and Varnish Production*, v. 49, no. 9, Aug. 1959, p. 47-49.

12735* Color Measurement and Specification. Explains fundamental measurements through spectrophotometry and color difference measurement with tri-stimulus colorimetry. *Paint, Oil & Chemical Review*, v. 122, July 9, 1959, p. 6-11.

12736* Study on Vacuum Deposition of Metals. I. On the Formation of Alloys by Successive Deposition of Constituent Metal Vapours in Vacuum. ***Yoshibumi Fujiki.*** *Physical Society of Japan, Journal*, v. 14, July 1959, p. 913-917.

12737* A Year of Outstanding Progress in Polyester Finishing. ***B. M. Letsky.*** *Product Finishing*, v. 12, July 1959, p. 36 + 5 pages.

12738 Hybrid Painting Machine Flow Coats, Sprays. System includes flow coaters equipped with spray guns to paint depressions. *Products Finishing*, v. 23, no. 11, Aug. 1959, p. 40-44.

12739* High-Density Polyethylene Protective and Functional Coatings. A practical method for spray application to metals is described. ***S. E. Hmiel and H. G. Guy.*** *SPE Journal*, v. 15, July 1959, p. 540-542.

12740 Silicones. Basic chemistry of silicones; general properties; manufacture; applications. ***R. N. Meals and F. M. Lewis.*** 267 pp. 1959. Reinhold Publishing Corporation, New York. (TP248.S5 M46s)

12741* Plasticizers in Polymer Floor Finishes. ***Harold Naidus, Henry Merken, and Henry M. Szczepanik.*** *Soap and Chemical Specialties*, v. 35, Aug. 1959, p. 81 + 4 pages.

12742 Society of Vacuum Coaters. 1958 Conference. Maintenance, operating and trouble shooting problems in vacuum coating systems, typical operating procedure, standard terms, an analytical method of leak determination in high vacuum systems, glow discharge cleaning, selection of oven equipment for vacuum coaters, spray painting and decorating, methods of high vacuum vapor coating control, new coating developments in vacuum metallizing, the dip dyeing of finishes for vacuum metallizing are discussed. 47 pp. + 16 plates. 1958. (TS695 So13t Over.)

12743* New Polyurethane Laminates Show Good Flexural Strengths. Di-isocyanate-based resins hold great promise for improved plastic materials. ***Angelo P. Bonnani.*** *Space/Aeronautics*, v. 32, no. 2, Aug. 1959, p. 87 + 3 pages.

12744* Antivibration Coatings and Their Application. Properties of some current antivibration materials and their effect. Specifications of coatings manufactured in Czechoslovakia are given together with examples of their applications. (*In Czech.*) Antivibrační nátěry a jejich použití. ***J. Němec and J. Ransdorf.*** *Strojírenství*, v. 9, no. 7, July 1959, p. 521-525.

12745 Research for Coatings for Protection of Niobium Against Oxidation at Elevated Temperatures. Preparation, testing procedures and results are described for both the alloy development and coating work. In the alloy work the oxidation rate of Nb at 2000 F was reduced by about a factor of 20 by additions of Ce, Cr, Ti, and Al. ***Emanuel C. Hirakis.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-545, Feb. 1959, 64 pp. (TL507 Un3.18w Vis.)

12746 Development of a Method to Accomplish Aluminum Deposition by Gas Plating. Deposition was accomplished by thermally decomposing vapors of tri-isobutyl Al on the surface of cleaned, heated Cu test panels in a plating chamber. ***Malvern J. Hiler and William C. Jenkin.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-88, June 1959, 57 pp. (TL507 Un3.18w Vis.)

12747* Electronic "Lockers" Get Critical Finishing Treatment to Resist Rugged Environment. ***Nat Wood.*** *Western Metalworking*, v. 17, Aug. 1959, p. 34-35.

See also: **12583** (rust protection of steel structures).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

12748* Limit-Cycle Stability Study of a Feedback Control System by a New Describing-Function Technique. New method leads to a stability diagram which is divided not into the usual two regions of "stable" and "unstable" operation but rather into numerous regions each of which is associated with a particular type of limit-cycle oscillation or singular point. ***H. J. Harrington.*** *Applications and Industry*, 1959, no. 43, July, p. 129-134.

12749* Notes on Bridged-T Complex Conjugate Compensation and 4- Terminal Network Loading. Analysis of the bridged- T network, normalized characteristics, effects of load-

ing impedance are discussed. Equations and sketches are cited. ***Prapat Chandaket and Allen B. Rosenstein.*** *Applications and Industry*, 1959, no. 43, July, p. 148-163.

12750* Abstracts of Papers Presented at the Plenary Sessions of the International Conference on Information Processing, Paris, 15-20 June 1959. Methods of digital computing, logical design of digital computers, common symbolic language for digital computers, automatic translation of languages, pattern recognition and machine learning, computer techniques of the future are discussed. *Association for Computing Machinery, Communications*, v. 2, July 1959, p. 9-23.

12751* On Precision of Pick-Up Using Hall-Effect. It is shown that in the case of a Hall Pick-Up, made of Ge, the accuracy of reading of the apparatus is basically affected by the error, created by the change of the Hall tension with the temperature. Consequently the increase of the preciseness requires a temperature compensation. (*In Russian.*) O tochnosti datchikov, ispol'zuiushchikh effekt kholla. ***L. S. Vasil'chenko, L. V. Sentiurina, and B. S. Sotskov.*** *Avtomatika i Telemekhanika*, v. 20, no. 7, July 1959, p. 939-945.

12752* Transistor-Magnetic Amplifiers. A simple scheme of a magnetic-semiconductor amplifier, in the outgoing cascade of which semiconductor triode tubes are used, which operate on the regime of change-over switching, is described. The combination of semiconductor and magnetic cascades permits amplifying systems with a highly rapid action and a high amplifying coefficient to be used. (*In Russian.*) Magnitnokristallicheskiĭ Usilitel'. ***O. A. Kossov.*** *Avtomatika i Telemekhanika*, v. 20, no. 7, July 1959, p. 988-991.

12753* A Negative Resistance for D.C. Computers. D.C. negative resistance suitable for use in analogue computers is described. The circuit uses two transistors and eight resistances and is compensated against unbalance in the two transistors. A nomogram has been constructed to simplify the design of the circuit for any required value of negative resistance. ***P. V. Indiresan.*** *British Institution of Radio Engineers, Journal*, v. 19, July 1959, p. 401-410.

12754* A Generalized Computer Procedure for the Design of Optimum Systems. I.-II. The procedure consists of a complex group of criteria which have been developed to unite a number of previously known mathematical techniques. The gradient design technique for solving system optimization problems consists primarily of a group of criteria for governing the application of gradient minimization procedures. ***R. Roderick Brown.*** *Communication and Electronics*, 1959, no. 43, July, p. 285-293.

12755 Applying the Digital Computer to Open-Hearth Operations. The proposal describes how to apply a digital computer and its electronic automatic control instruments to open-hearth furnace operations. For the steel industry, installation of such a computer-logger system will be a major step toward eventual closed-loop control. *Control Engineering*, v. 6, Aug. 1959, p. 94-100.

12756* The Parametron, a Digital Computing Element Which Utilizes Parametric Oscillation. A parametron element is essentially a resonant circuit with a nonlinear reactive element which oscillates at one-half the driving frequency. The oscillation is used to represent a binary digit by the choice between two stationary phases π radians apart. ***Eiichi Goto.*** *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1304-1316.

12757* Microwave Parametric Subharmonic Oscillators for Digital Computing. A variable capacitance subharmonic oscillator having an output frequency of 2000 mc is described, and the use of this oscillator in circuits for amplifying, scaling, and performing logic functions is discussed. The circuits described operate at pulse repetition rates exceeding 100 mc. ***Fred Sterzer.*** *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1317-1324.

12758 Thin-Film Memories. A small random-access memory using deposited magnetic thin films as storage elements, and with a cycle time of one microsecond, is described. Information is read from or written into the memory by linear or word selection techniques. The addressing, driving and sensing circuits are transistorized. The deposited thin films are 2000 Å thick, switch in 0.1 μsec, and generate a 5-mv output signal in the sense winding. A sense signal is obtained of opposite polarity from a selected element when a "1" or a "0" is read out. A memory-plane wiring configuration has been selected which is least susceptible to noise. ***Eric E. Bittmann.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 92-97. (TK1 In6.6e Vis.)

12759 Integrated Devices Using Direct-Coupled Unipolar Transistor Logic. A new logic system using directly-coupled unipolar transistors is analyzed. Shows: that unipolar transistors have important advantage over bipolar transistors in speed, tolerance of stray signals and noise, and device miniaturization; devices of extreme miniaturization built by an integrated device design using this logic system; how the passive components of the system, in this case resistors, have been integrated into the semiconductor devices. ***J. T. Wallmark and S. M. Marcus.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 98-107. (TK1 In6.6e Vis.)

12760 *P-N-II-N* Triode Switching Applications. Unit is capable of handling short pulses of current of the order of 100 amperes. The electrical characteristics are controllable by the base lead, and hence make it a flexible device for applications in the computer and communications fields. Two particular circuits discussed are an 80-ampere 500-mμsec pulse generator with rise and fall times in the order of 150 mμsec and 300 mμsec respectively, that can operate up to a kilocycle repetition rate, and a 4-ampere 60-mμsec pulse generator with a PRF of 100 kc. ***V. H. Grinich and I. Haas.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 108-113. (TK1 In6.6e Vis.)

12761 An Electro-Optical Shift Register. Composed only of electroluminescent (EL) and photoconductive (PC) cells, it is amenable to construction in an extremely small volume, and has certain other unique characteristics. ***T. E. Bray.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 113-117. (TK1 In6.6e Vis.)

12762 Processing Data in Bits and Pieces. Describes a data-handling unit which permits binary or decimal arithmetic to be performed on data fields of any length from one to sixty-four bits. Within the field, character structure can be further specified: these processing entities, called bytes, may be from one to eight bits long. Fields may be stored with or without algebraic sign. On all operations, the relative offset or shift between the operand from memory and that from the accumulator can be specified. Three new logical instructions allow any of the 16 logical connectives of two variables to operate upon each pair of bits in the memory and accumulator operands. The variable field length, variable byte-size features, extend the use of connective operations to a surprisingly wide variety of logical, house-keeping, and editing tasks. The initial application of the variable field length data-processing unit is in the IBM Stretch computer. ***F. P. Brooks, Jr., G. A. Blaauw, and W. Buchholz.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 118-124. (TK1 In6.6e Vis.)

12763 Increasing Reliability by the Use of Redundant Machines. Attempts to break down cost of operating a digital computer, and to determine relationship between cost and system failure. Discusses three specific cases. ***D. E. Rosenheim and R. B. Ash.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 125-130. (TK1 In6.6e Vis.)

12764 Boolean Matrix Equations in Digital Circuit Design. Specifically, all sets of Boolean functions $f_1(A_1, \ldots, A_1), \ldots, f_J(A_1, \ldots, A_1)$ are found such that if circuits with these outputs are connected to a circuit that generates the known Boolean function $F(f_1 \ldots, f_J, X_1, \ldots, X_K)$, then the output will produce a given desired function $E(A_1, \ldots, A_1, X_1, \ldots X_K)$. Presents illustrative examples of the method. ***Robert S. Ledley.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 131-139. (TK1 In6.6e Vis.)

12765 The Residue Number System. Discusses arithmetic operations and conversion process required to convert from a residue code to a weighted code. Concludes that in its present state the residue code is probably not suitable for general purpose computation but is suitable for a special class of control problems. ***Harvey L. Garner.*** *IRE Transactions on Electronic*

Computers, v. EC-8, no. 2, June 1959, p. 140-147. (TK1 In6.6e Vis.)

12766 Bibliography of Digital Magnetic Circuits and Materials. A list of about 400 references relating to magnetic memory and logic circuits has been made. The bibliography is divided into 19 sections. Several sections are devoted to the physical, magnetic, and switching parameters of magnetic materials. Other parts cover the circuit and logical aspects of using magnetic cores, plates, "twistors", thin films, and transfluxors. Attention is given to the use of special memory techniques such as domain wall viscosity readout, cross-field effects, and circuits operated with RF carriers. The use of magnetic cores as half adders, gates, and shift registers is recognized in a separate section. A listing of sources of further information (conference proceedings, books, and other bibliographies) is included. ***Walter L. Morgan.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 148-158. (TK1 In6.6e Vis.)

12767 The Recording and Reproduction of Signals on Magnetic Medium Using Saturation-Type Recording. The effect on the recording process of the *B-H* characteristics of the coating, coating thickness, record-head gap width, head-to-coating separation, self-demagnetization, and record-head residual magnetization are discussed. Equations are derived for the playback process relating the signal amplitude and pulse width to the coating thickness, head-coating separation, and effective gap width of the playback head. It is shown that the greatest improvement in resolution can be obtained by the development of an extremely thin coating with high ratio of coercitivity to remanence and having a rectangular *B-H* loop. ***J. J. Miyata and R. R. Hartel.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 159-169. (TK1 In6.6e Vis.)

12768 Magnetic Core Logic in a High-Speed Card-to-Tape Converter. This report describes a static magnetic shift circuit and the logical connectives derived from it. The prime advantages of magnetic circuits are their low cost, high reliability, and ease of maintenance. The application of these circuits to the design of a card-to-tape converter is discussed. ***E. Bloch and R. C. Paulsen.*** *IRE Transaction on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 169-181. (TK1 In6.6e Vis.)

12769 The Use of a Repetitive Differential Analyzer for Finding Roots of Polynomial Equations. The procedure requires only operational amplifiers and ganged linear potentiometers. Differential analyzers are very suitable for solving algebraic equations since they permit visual checking of the procedure and make it possible to investigate how the roots of the polynomial are affected by variation of its coefficients. The procedure is not iterative. ***P. Madich, J. Petrich, and N. Parezanovich.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 182-185. (TK1 In6.6e Vis.)

12770 A High-Speed Analog-Digital Computer for Simulation. Information in the machine is represented by an analog voltage pulse and a digital number. Arithmetic operations are performed in time-shared analog computing components and conventional digital logical elements. A novel floating-point arithmetic feature is provided to extend the dynamic range of the machine variables. Instructions and constants are stored on a magnetic drum before computation begins. Both the instructions and constants are arranged so that random access to the drum is not needed. The programming techniques developed for the computer are described. ***R. C. Lee and F. B. Cox.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 186-196. (TK1 In6.6e Vis.)

12771 Distributed Parameter Vibration With Structural Damping and Noise Excitation. A method is described for the electronic analog computer that will permit the determination of the vibration amplitude responses of a distributed system with structural damping to a random-noise excitation such as might be experienced by a missile structure accelerated by a jet propulsion system. ***R. V. Powell.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 197-200. (TK1 In6.6e Vis.)

12772 Optimization by Random Search on the Analog Computer. Gaussian noise sources generate values of the independent parameters and sample-hold circuits hold those values which give the best value of the optimization criterion. An application of the method to a production allocation problem is mentioned. ***J. K. Munson and A. I. Rubin.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 200-203. (TK1 In6.6e Vis.)

12773 Linear System Approximation by Differential Analyzer Simulation of Orthonormal Approximation Functions. In the procedure developed in this paper, a group of N linear approximating systems with orthonormal impulse responses $\phi_n(t)$ are realized by operational amplifier circuits. The following points relative to the approximation procedure are developed: constrained and weighted integral-square-error approximations, derivation and realization of orthonormal functions, physical realization of $h^*(t)$, evaluation of error $h(t)$-$h^*(t)$, and analysis of computer errors. Several approximation examples are given. ***Elmer G. Gilbert.*** *IRE Transactions on Electronic Computers*, EC-8, no. 2, June 1959, p. 204-209. (TK1 In6.6e Vis.)

12774 Generalized Integration on the Analog Computer. Describes the results on an attempt to use Padé time-delay units in generalized integration, and presents development of a new analog integrator based on a simple numerical integration formula. The integrator can be instrumented using standard analog computer components. The performance of the device is illustrated with several examples. ***George A. Bekey.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 210-217. (TK1 In6.6e Vis.)

12775 A Perturbation Technique for Analog Computers. Study of the motion of a fin-stabilized rocket to determine the effect of perturbing forces on the trajectory. Technique is applied to the two-dimensional motion of a rocket in the vertical plane and includes perturbations due to uncertainties in winds, atmospheric density, thrust malalignments, and stability margin. ***L. Bush and P. Orlando.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 218-221. (TK1 In6.6e Vis.)

12776 A Four-Quadrant Multiplier Using Triangular Waves, Diodes, Resistors, and Operational Amplifiers. A practical circuit utilizes one operational amplifier to obtain $-(X + Y)/2$ and a second such unit to measure the summing point current. Addition of four auxiliary diodes reduces circuit interactions and makes less stringent requirements on the diodes. A simple means for obtaining the precise resistance balance is outlined. Calibration does not depend upon triangular wave frequency or symmetry. The amplifiers are not required to handle the triangular wave frequencies. ***Paul E. Pfeiffer.*** *IRE Transactions on Electronic Computers*, v. EC-8, no. 2, June 1959, p. 222-227. (TK1 In6.6e Vis.)

12777 Sampled-Data Control Systems. This book deals with the theory of sampled-data systems. ***John R. Ragazzini and Gene F. Franklin.*** 331 pp. 1958. McGraw-Hill, New York. (TJ216 R12s)

See also: **13578** (telephone exchange ventilation).

ELECTRICAL ENGINEERING

12778 Optimization of a Conventional-Fuel-Fired Thermoelectric Generator. Equations have been developed for: temperature distribution of the heated gas in a circular duct type of generator, that maximizes thermoelectric power output, thermoelectric power developed, based upon these optimizing temperature criteria, required variation of thermoelectric element thickness required to satisfy both optimizing temperature criteria, and the thermal efficiency under optimum conditions. ***B. W. Swanson and E. V. Somers.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 81, no. 3, Aug. 1959, p. 245-248.

12779* "Magnistor" Devices for Digital and Logic Circuits. Using a multiple-flux-path configuration combining a "soft" magnetic ferrite with a mildly "hard" ferrite, the Potter Instrument Co. has developed a new solid-state component with the properties of a 1-bit comparator. *Electrical Manufacturing*, v. 64, Aug. 1959, p. 74-77.

12780* Current-Controlled D-C Motor Drive. Use of the regulated-current principle for controlling the speed of a d-c motor represents a major development in the field of adjustable-speed drives. Ignitrons and thyratrons are employed in the system. ***E. H. Dinger.*** *Electrical Manufacturing*, v. 64, Aug. 1959, p. 78 + 7 pages.

12781* Some Broad-Band Transformers. Several transmission line transformers are described which have bandwidth ratios as high as 20,000:1 in the frequency range of a few tens of kilocylces to over a thousand megacycles. These transformers can be made quite small. Excellent transformers have been made using ferrite toroids having an outside diameter of 0.080 inch. ***C. L. Ruthroff.*** *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1337-1342.

12782 Ceramic Electrical Insulation. I. The production of insulators from porcelain, steatite, forsterite, cordierite, mullite, spinel, alumina, magnesia, and quartz is discussed. ***Barlane R. Eichbaum.*** *Insulation*, v. 5, Aug. 1959, p. 11-17.

12783* Electrical Small Operation of a Magnetic Pole of Saturated Machines by Means of a D.C. Pole in a Conductive Sheet. The calculation of the magnetic pole in a ferromagnetic medium was expressed by an integral equation which it was possible to solve by means of the model described. The algorism used can be reproduced on a calculating machine using figures. (*In Russian.*) Elektromodelirovanie magnitnogo polia nasyshchennykh machin polem postoiannogo toka v provodiashchem liste. ***V. M. Alekhin and O. B. Tozoni.*** *Izvestiia Vysshikh Uchebnykh Zavedenīĭ, Elektromekhanika*, v. 2, no. 1, 1959, p. 3-11.

12784* Calculation of the Mechanical Characteristics of the Cramer Cascade With a Single Anchor Converter. The statistic and mechanical characteristics of a main and of an auxiliary induction motor were calculated with sufficient accuracy by means of the analytical method described and in spite of the special difficulty of determining the inductive resistance of the single anchor converter. (*In Russian.*) Raschet mekhanicheskikh kharakteristik kaskada Kremera s odnoiakornym preobrazovatelem. ***I. N. Birulia and N. D. Moniushko.*** *Izvestiia Vysshikh Uchebnykh Zavedenīĭ, Elektromekhanika*, v. 2, no. 1, 1959, p. 54-62.

12785* Selection of a Method for the Study of the Distribution of Power in a Low Conductive Medium of Electric Furnaces for Applied Purposes. The conditions of resemblance of electric alternating poles applied in a low conductive medium of an electric furnace (slag, charge) and other mediums (electrolytes, water) can be reduced to a geometrical resemblance, a similarity of the conductance distribution in these mediums, and to a very close resemblance of the boundary conditions. (*In Russian.*) Vybor metodiki izucheniia raspredeleniia moshchnosti v slaboprovodiashcheĭ srede elektropecheĭ dlia prikladnykh tselei. ***G. F. Platonov.*** *Izvestiia Vysshikh Uchebnykh Zavedenīĭ, Energetika*, 1959, no. 4, Apr., p. 62-72.

12786 Strains Induced in Transmission-Line Cables by Aeolian Vibration. *R. F. Steidel, Jr.* Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959. p. 109-120. (TG265 So13p Vis.)

See also: **12425** (Si photovoltaic cells); **12526** (dielectric glasses); **12712** (electrical insulation); **13306** (conductivity of disperse mixtures); **13337** (nuclear electric power generator).

ELECTROCHEMISTRY

12787* Equilibrium Electrode Potentials of Some Metal-Chlorine Galvanic Cells and Activities of Some Metal Chlorides in LiCl-KCl Eutectic Melt. Equilibrium electrode potentials of 12 metal-chlorine galvanic cells in LiCl-KCl eutectic melts were measured. The results indicate the order of the electrolytic decomposition of these metal chlorides in LiCl-KCl eutectic melt as a function of temperature and concentration. AgCl shows positive deviation and $PbCl_2$, $CdCl_2$, $ZnCl_2$, $MgCl_2$, and $BeCl_2$ show negative deviation from Raoult's law. ***L. Yang and R. G. Hudson.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 589-601.

12788 The Silver/Silver Chloride/Chlorine Solid Electrolyte Cell. Chlorine is furnished by the dissociation of $KICl_4$. These cells can be assembled into batteries which are extremely stable and compact and which deliver currents in the microampere range. The dissociation characteristics of the cathode salt influence the shelf-life, temperature dependence of the open-circuit voltage (OCV), and the change of OCV with aging. ***Donald M. Smyth.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 635-639.

12789 The Growth of Barrier Oxide Films on Aluminum. The growth of anodically formed barrier oxide films on Al was followed by weight, capacitance, and rate measurements. The increase of film thickness at constant voltage was calculated and compared to the values obtained by optical measurements. ***W. J. Bernard and J. W. Cook.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 643-646.

12790 Electroclad Aluminum on Uranium. Electroplating of Al was studied as an alternative method for Al cladding of U fuel elements. Uranium electroclad with 12 mils of Al over a 0.5-mil Ni or Ni + Cu electroplate resisted corrosion for more than 100 hr. in boiling water. Hot pressing the electroclad composite improved the corrosion resistance. Many of the results obtained with Al electrocladdings paralleled those obtained with wrought Al claddings on U. ***John G. Beach and Charles L. Faust.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 654-659.

12791 Junction Delineation on Silicon in Electrochemical Displacement Plating Solutions. Antimony, Cu, Ag, Pt, and Au were deposited on abraded and polished n- and p-type Si. ***D. R. Turner.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 701-705.

12792 The Relation of Gas Composition to Current Efficiency in an Aluminum Reduction Cell. Experience with a 10,000-amp cell indicates that the previously accepted equation relating current efficiency and cell gas CO_2 concentration is an oversimplification. A modified equation fits the data more satisfactorily. ***T. R. Beck.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 710-713.

12793 Electromotive Force Series of Metals in Fused Salts and Activities of Metal Chlorides in 1:1 Molar KCl-NaCl Solutions. Experiments with a chlorine electrode have shown that the solutions of AgCl in the KCl-NaCl solvent are ideal, and hence, deviations from ideality of the other chlorides in this solvent can be attributed directly to the formation of complexes in the melts. The theoretical aspects of complex formation in melts are discussed. ***S. N. Flengas and T. R. Ingraham.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 714-721.

12794 Electrokinetic Measurements on Stainless Steel Capillaries. Electrokinetic potentials of stainless steel in HCl, H_2SO_4, and $K_2Cr_2O_7$ solutions were measured by the streaming current technique. ***B. Levy and A. R. Fritsch.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 730-735.

12795 Smooth Copper and Nickel Deposits. Decorative Cu and Ni deposits are particularly liable to roughness produced by insoluble particles present in the solution. Describes sources and characteristics of these particles. ***D. R. Newman.*** *Electroplating and Metal Finishing*, v. 12, Aug. 1959, p. 296-298.

12796 Porosity of Nickel Coatings. Causes of porosity; remedial measures. ***A. L. Rotinyan, N. P. Fedot'ev, E. E. Mishchenkova, and Dë Du-kho.*** *Electroplating and Metal Finishing*, v. 12, Aug. 1959, p. 304-306.

12797 Electrolytic Copper Refining at High Current Densities. Evidence points to the fact that minimum Cu refining costs can be achieved at higher current densities than are currently employed. Describes Cu refining experiments conducted at current densities up to 500 amps per sq. m. in specially constructed channel cells. ***S. J. Wallden, S. T. Henriksson, P. G. Arbstedt, and Th. Miöen.*** *Journal of Metals*, v. 11, Aug. 1959, p. 528-534.

12798* Electrodeposition of Chromium Alloys. Aqueous baths to obtain crack-free Cr electrodeposits with different Cr alloys. ***Charles Levy.*** *Metal Finishing*, v. 57, Aug. 1959, p. 59 + 4 pages.

12799* Analysis of Sulfuric Anodizing Solutions. ***J. B. Mohler.*** *Metal Finishing*, v. 57, Aug. 1959, p. 63-65.

12800* Bright, Non-Brittle Acid Copper Deposits. Process using thiourea. ***Larissa Domnikov.*** *Metal Finishing*, v. 57, Aug. 1959, p. 66 + 2 pages.

12801* Science for Electroplaters. Pt. L. Copper Plating. II. Study of leveling and leveling measurements. ***L. Serota.*** *Metal Finishing*, v. 57, Aug. 1959, p. 72 + 2 pages.

12802 Batteries Retain Their Power Role. Present and future status of electrochemical batteries and their applications to missiles and satellites. ***Charles D. LaFond.*** *Missiles and Rockets*, v. 5, no. 35, Aug. 24, 1959, p. 15-17.

12803* Design and Operation Problems of a Continuous Automatic Plating Waste Treatment Plant. Conservation of water in the plating department, by use of an automatically controlled counter-current multiple rinsing system, has resulted in a design flow which utilizes less than one-fourth the water volume previously anticipated. The load on the waste treatment plant has been further decreased. ***Neil H. Hanson and Walter Zabban.*** *Plating*, v. 46, Aug. 1959, p. 909-918.

12804* Optimized Metal Finishing Recovery System. New installation solved the waste disposal problem, recovered essentially all of the chemicals formerly lost, maintained the bath at a steady operating temperature, reduced water consumption for dilution of wastes, and utilized waste process heat. ***Walter F. Swanton.*** *Plating*, v. 46, Aug. 1959, p. 919-921.

12805* Disposal of Plating Room Wastes. Effect of plating room wastes on the sewage disposal system and how various wastes constituents are removed in the treatment plant. Basic chemical reactions. ***Robert V. Day.*** *Plating*, v. 46, Aug. 1959, p. 929-931.

12806* Some Engineering Aspects of a Good Filtration System. Piping arrangement and filter location, as well as solution discharge velocity, are of prime importance in the elimination of rough electrodeposits. ***Chester G. Borlet.*** *Plating*, v. 46, Aug. 1959, p. 932-933.

12807* The Nature, Cause and Effect of the Porosity in Electrodeposits. IV. Influence of Gas Bubbles on the Formation of Pores. One mechanism for the formation of a pore in electrodeposits involves the inclusion of a surface gas bubble. Whether the pore becomes continuous or bridged depends upon the relative rates of H discharge and Ni deposition. A cell is described which permits the observation of a simulated "cross section" of a Ni deposit while it is being formed. ***Fielding Ogburn and D. W. Ernst.*** *Plating*, v. 46, Aug. 1959, p. 957-958.

12808 Electrorefining Titanium, Using an Internally Heated Cell. Excellent metal quality, with lower power requirement, is attained by using internal heating of the fused-salt bath. An internal heater provides more effective heat utilization, simplifies structural components in cell design, and prolongs cell life by eliminating direct application of heat to the cell container. ***O. Q. Leone, J. R. Nettle, and D. H. Baker, Jr.*** *U. S. Bureau of Mines Report of Investigations* 5494, 1959, 20 pp. (TN21 Un3r Vis.)

See also: **13109** (extraction of Ti); **13137** (effects of surface defects on electroplate).

ELECTRONICS

12809 ASTM Standards on Electron-Tube Materials. 242 pp. Dec. 1957, American Society for Testing Materials, Philadelphia. (TK7872.V3 Am35s)

12810 Method of Improving Acoustic Transmission in Folded Horns. A novel principle has been developed, applicable to folded horns, for improving the acoustic transmission around bends having a radius greater than one-quarter wavelength. This consists of the use of a conoidal reflecting type surface in the outer half of the fold. It is beneficial in the frequency-spacial region between the usual horn wave expansion action and transmission by specular or optical type reflection. A practical application is described. ***Richard W. Carlisle.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1135-1137.

12811 Fine Structure in the Hall Coefficient. Measurements of the Hall coefficient as a function of magnetic field in the extrinsic region of semi-conductors such as *p*-type Ge, Si, diamond, and AlSb, reveal a fine structure consisting of maxima and minima. For *p*-type Ge, the minima occur at a magnetic field strength in the neighborhood of the experimental data at 77 K. In Si, with a lower mobility ratio between light- and heavy-mass bands, the structure resulting from the warped band is generally not obscured by contributions from the light-mass band, and the maximum is very much in evidence. ***A. C. Beer.*** Paper from "Advances in Semi-Conductor Science. Proceedings of the Third International Conference on Semi-Conductors Held at the University of Rochester, U.S.A., August 18-22, 1958", Pergamon Press, New York. 1959, p. 507-511.

12812 Measurement of the Galvanomagnetic Effects in Pure Tellurium. ***H. Roth.*** Paper from "Advances in Semi-Conductor Science. Proceedings of the Third International Conference on Semi-Conductors Held at the University of Rochester, U.S.A., August 18-22, 1958", Pergamon Press, New York. 1959, p. 525-530.

12813 Microwave Radio-Relay Towers. Types of towers, accomodating wind forces and guyed tower design are discussed. ***H. A. Wells.*** *Bell Laboratories Record*, v. 37, Aug. 1959, p. 299-304.

12814* Ultraharmonic and Subharmonic Resonance in an Oscillator. Different order subharmonic and ultraharmonic resonance curves for an oscillator with a cubic non-linearity are obtained theoretically by van der Pol's method. Their distinctive features are discussed. ***B. R. Nag.*** *British Institution of Radio Engineers, Journal*, v. 19, July 1959, p. 411-416.

12815* Photo-Electric Image Techniques in Astronomy. The underlying scientific principles of light detectors such as the human eye, photographic emulsion or photo-electric device, are explained and their quantum efficiencies compared in terms of signal/noise ratio. Television techniques can be applied to aid astronomical observations and help to overcome, in some measure, the fundamental problems in observing celestial objects through the semi-transparency of the Earth's atmosphere. ***B. V. Somes-Charlton.*** *British Institution of Radio Engineers, Journal*, v. 19, July 1959, p. 417-435.

12816* The Use of Pre-Pulse Techniques in High-Speed Oscillography. The recording of single transients of very short rise time and duration has necessitated the development of ultra-high-speed oscilloscopes. It is shown how the high-frequency range of conventional oscilloscopes and associated amplifiers can be extended by switching them into operating conditions of high current for only a very short part of the duty cycle. ***F. E. Whiteway.*** *British Institution of Radio Engineers, Journal*, v. 19, July 1959, p. 439-449.

12817 Arrays of Inorganic Semiconducting Compounds. Arrays of compounds related to the periodic chart of the elements can be prepared. These arrays aid in estimating the physical and chemical properties of compounds, including semiconducting properties. ***A. J. Cornish.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 685-689.

12818* Meter Measures Noise Figure. Automatic meter measures the effect of internally generated noise upon the signal-to-noise ratio of a system. A description of its basic principles and method of operation of each stage is given. ***Howard C. Poulter.*** *Electronic Equipment Engineering*, v. 7, Aug. 1959, p. 36-40.

12819* Measuring Spot Size High-Resolution Cathode-Ray Tubes. An analysis of equipment which can measure spot size less than 0.0005 in. with reproducibility of about 10% of spot diameter. Routine measurement can be made to clearly show differences in spot size even where shrinking raster or video test

pattern methods prove inadequate because of human errors. ***Laurence E. White.*** *Electronic Equipment Engineering*, v. 7, Aug. 1959, p. 46-50.

12820* Miniature Permeability Tuned Devices. Several new permeability tuned elements which operate in the frequency range from 100 kc to 45 mc are described. Certain aspects of their design including frequency ranges, linearity, i-f selection and tracking are analyzed. ***Edward A. Abbot.*** *Electronic Equipment Engineering*, v. 7, Aug. 1959, p. 59-62.

12821 New Microwave Systems Using Low-Noise Devices. Packaged masers and parametric amplifiers are dominating new receiver designs in microwave systems for military applications. Junction diode mavars are boosting revival prospects of uhf television. ***Thomas Maguire.*** *Electronics*, v. 32, no. 34, Aug. 21, 1959, p. 27-30.

12822 Determining Transistor High-Frequency Limits. The most direct method of ascertaining the upper frequency limit of transistor performance is by measurement of the maximum frequency of oscillation. Describes technique which uses a coaxial element structure which extends the range of such measurements up to 1,000 mc. ***J. Lindmayer and R. Zuleeg.*** *Electronics*, v. 32, no. 34, Aug. 21, 1959, p. 31-33.

12823 Long Wavelength Infrared Detector Cooling Systems. Cooling these detectors to very low temperatures reduces the internal molecular and atomic thermal agitation to a minimum and allows the desired spectral response to be obtained. ***A. I. Weinstein.*** *Electronics*, v. 32, no. 34, Aug. 21, 1959, p. 36-37.

12824 Oscillator Design Using Voltage-Variable Capacitors. Reverse-biased p-n junction diode is used as variable capacitor in design of linear frequency sweep generator. Output waveform is a sinusoid of high purity. Frequency is swept from 400 to 600 kc electronically. Frequency markers are provided. ***M. Michael Brady.*** *Electronics*, v. 32, no. 34, Aug. 21, 1959, p. 38-40.

12825 How to Design Bandpass Triples. Complex problem gets a thorough treatment. Equations are presented in terms of fundamental parameters and an example is worked out. Cascading for very wide bandpass is practical and a design method is included. ***Ronald B. Hirsch.*** *Electronics*, v. 32, no. 34, Aug. 21, 1959, p. 41 + 2 pages.

12826* The Radiansphere Around a Small Antenna. The "radiansphere" is the boundary between the near field and the far field of a small antenna. Its radius is one radianlength ($\lambda/2\pi$), at which distance the three terms of the field are equal in magnitude. A "small" antenna is one somewhat smaller than the radiansphere, but it has a "sphere of influence" occupying the radiansphere. ***Harold A. Wheeler.*** *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1325-1331.

12827* Voltage Breakdown Characteristics of Microwave Antennas. Voltage breakdown occurs at power levels when the pressure is reduced. The minimum breakdown potential occurs approximately at the pressure where the frequency of collision between electrons and gas atoms is equal to the frequency of the applied field. ***J. B. Chown. W. E. Scharfman. and T. Morita.*** *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1331-1337.

12828* Dissipation Loss in Multiple-Coupled-Resonator Filters. This paper examines the effect of dissipation on the response of multiple-coupled-resonator filters designed from lossless prototype low-pass filters. A simple approximate formula makes possible the computation of center-frequency loss in terms of bandwidth, unloaded Q of the resonators, and the parameters of the prototype filter. ***Seymour B. Cohn.*** *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1342-1348.

12829* IRE Standards on Navigation Aids: Direction Finder Measurements, 1959. *I.R.E. Proceedings*, v. 47, Aug. 1959, p. 1349-1371.

12830 On the Response and Approximation of Gaussian Filters. This paper discusses a filter whose amplitude response characteristic is e^{-ky^2} where γ is a function of frequency and k is a constant related to the filter bandwidth. The responses to impulse and step functions are discussed. A method for designing an approximate Gaussian filter is given and the measured responses are presented. ***J. Klapper and C. M. Harris.*** *IRE Transactions on Audio*, v. AU-7, no. 3, May-June 1959, p. 80-87. (TK1 In6.6au Vis.)

12831 Report of Advances in Microwave Theory and Techniques in U. S. A.—1958. ***R. E. Beam and M. E. Brodwin.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 308-325. (TK1 In6.6mt Vis.)

12832 Report of Advances in Microwave Theory and Techniques in Great Britain—1958. ***John Brown.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 325-327. (TK1 In6.6mt Vis.)

12833 Report of Advances in Microwave Theory and Techniques in Western Europe—1958. ***Georges Goudet.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 327-330. (TK1 In6.6mt Vis.)

12834 Report of Advances in Microwave Theory and Techniques in Japan—1958. ***Isao Someya.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 331. (TK1 In6.6mt Vis.)

12835 A Ferrite Cutoff Switch. The theory and operating characteristics of a new type of high performance reflective switch is given. It utilizes the cut-off phenomenon in transversely magnetized ferrites. The insertion loss of the device is 0.4 db and over 60 db within the 8.8 to 9.5 kmc band when the ferrite is demagnetized and magnetized respectively. The reflection coefficient of the switch in the "off" state is more than 90% over the same band. In contrast to most other ferrite devices, it is of the reflective rather than the absorptive type. Furthermore, it has the unique property that its operating bandwidth is determined mainly by the magnitude of the applied field. Possible applications of the device in antenna switching and as a tunable cut-off filter is discussed. ***R. F. Soohoo.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 332-336. (TK1 In6.6mt Vis.)

12836 Propagation Constants of Circular Cylindrical Waveguides Containing Ferrites. Describes some results of a theoretical and experimental investigation of the propagation behavior of circular cylindrical waveguides containing longitudinally magnetized ferrite rods. Faraday rotation measurements have been made between 5000 and 7600-mcs using commercially available ferrites. Reasonable agreement between theoretical and experimental results has been found for a thin axial ferrite rod in an air-filled guide in both cases of saturated and nonsaturated ferrites. Energy concentration in the ferrite determines the propagation behavior in the partially filled waveguide. This effect can be enhanced by surrounding the ferrite rod with a dielectric tube. For a given rod diameter and permittivity of the tube there is an optimum outer diameter of the tube for which the Faraday-rotation becomes maximum. ***H. K. F. Severin.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 337-346. (TK1 In6.6mt Vis.)

12837 Magnified and Squared VSWR Responses for Microwave Reflection Coefficient Measurements. Shows how radically different types of response are obtainable in which the observed ratio may approximately equal the square of the VSWR or may be magnified any desired amount. Accuracies of 0.1% in VSWR to 2.0 have been achieved using magnified response techniques. ***R. W. Beatty.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 346-350. (TK1 In6.6mt Vis.)

12838 Microwave Reflectometer Techniques. It is shown how the reflectometer technique may be further simplified while preserving the accuracy of measurement. A convenient method of adjusting the auxiliary tuners is described, sources of error are discussed, and an example is given of the calculation of error limits. ***G. F. Engen and R. W. Beatty.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 351-355. (TK1 In6.6mt Vis.)

12839 Application of a Backward-Wave Amplifier to Microwave Autodyne Reception. A microwave receiver using a single-circuit backward-wave amplifier as a combination radio-frequency amplifier and homodyne local oscillator is described. The amplifier tube is operated at a value of beam current just

above that required to maintain oscillation. It is shown that in this way, the high gain and narrow bandwidth of the single-circuit backward-wave amplifier may be utilized in an electronically tunable microwave receiver. ***J. K. Pulfer.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 356-359. (TK1 In6.6mt Vis.)

12840 Mode Theory of Lossless Periodically Distributed Parametric Amplifiers. In this paper, an operator $T\theta$ is introduced for the analysis of the periodically distributed parametric amplifier. The operator is the product of a diagonal matrix expressing the pumping phase relation and the T matrix of the basic section of the amplifier. The eigenvectors of $T\theta$ are called the "modes" of the amplifier. The orthogonality properties of the modes are proved in a similar way as for the conventional mode theory. Finally, an expression is derived for the power gain of the amplifier as an application of the theory. ***K. Kurokawa and J. Hamasaki.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 360-365. (TK1 In6.6mt Vis.)

12841 O-Guide and X-Guide: An Advanced Surface Wave Transmission Concept. This paper describes the O-guide and X-guide which are proposed by the authors and are the advanced surface waveguides composed of thin dielectric sheets. The results of an analysis of the TE fundamental mode in the O-guide are described, and the theoretical characteristics as a transmission line are discussed. The practical guides are suitable especially for the SHF region and guides can be obtained which have lower attenuation constants than coaxial lines, G-lines, and rectangular waveguides. ***M. Sugi and T. Nakahara.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 366-369. (TK1 In6.6mt Vis.)

12842 The Transmission of TE_{01} Wave in Helix Waveguides. Relations are investigated between the transmission characteristics of a helix waveguide and its surface impedance in regions where any simple approximate formulas are not available because of the magnitude of the surface impedance. The numerical calculations show that, for any given value of the surface impedance and the angular mode index, there exist an infinite number of different modes which are distinguishable from each other by different values of the radial propagation content. ***Toshio Hosono and Shishu Kohno.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 370-373. (TK1 In6.6mt Vis.)

12843 Design of Linear Double Tapers in Rectangular Waveguides. Considers the problem of a taper connecting two uniform waveguides of arbitrary dimensions and propagating a single mode; an approximate expression for the reflection coefficient is derived. The special case of a linear double taper in rectangular waveguide is examined in detail for propagation in the TE_{10} mode. Approximate expressions for the reflection coefficient and voltage standing wave ratio as functions of the taper dimensions and free space wavelength are derived and experimentally verified. ***R. C. Johnson.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 374-378. (TK1 In6.6mt Vis.)

12844 Spurious Mode Generation in Nonuniform Waveguide. This paper deals with the problem of a nonuniform waveguide joining two uniform ones and the spurious modes generated by it when a pure mode is incident in one of the uniform waveguides. The generalized telegraphist's equations are stated and transformed into a set of differential equations for the amplitudes of the forward and backward traveling waves. The expressions for the coupling coefficients between the various modes are given and analyzed. ***L. Solymar.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 379-383. (TK1 In6.6mt Vis.)

12845 A High Power Diplexing Filter. An L-band diplexing filter has been constructed with an estimated power-carrying capacity of 5 megw at atmospheric pressure (for a power safety factor of nearly four to one) and an insertion loss of less than 0.1 db. The filter consists of two hybrid junctions and two high pass waveguide sections, which are arranged as in a balanced duplexer, with the "TR-tubes" replaced by the high-pass sections. In the upper frequency band, the input VSWR is better than 1.10 over a seven and one-half per cent bandwidth, but deteriorates only slightly over a larger bandwidth. In the lower frequency band, the input VSWR is better than 1.32 over a 13% bandwidth. The separation interval between these two bands is approximately 10% between their nearest frequencies. ***Leo Young and John Q. Owen.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-7, no. 3, July 1959, p. 384-387. (TK1 In6.6mt Vis.)

12846 International Scientific Radio Union U. R. S. I. Committee reports from various countries on such subjects as ultra short wave propagation, VHF ionospheric propagation, atmospheric noise, and radio astronomy stations. *International Scientific Radio Union, Information Bulletin*, no. 113, Jan.-Feb. 1959, p. 1-114. (TK6540 In8i Contin.)

12847 Radiation Effects in Semiconductors: Thermal Conductivity and Thermoelectric Power. ***T. H. Geballe.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1153-1157.

12848 Transport Properties in Silicon and Gallium Arsenide. High-purity n- and p-type Si has been irradiated lightly with Co^{60} γ rays. Analysis of the Hall mobility and magnetoresistance data indicate the introduction of levels near the conduction and valence bands. The analysis suggests the presence of triply ionized acceptors and singly ionized donors. The third ionization state of the acceptor apparently produces a level above the center of the band gap. Under more extensive irradiation a double ionization of the donors can account for the observed high resistivity. An initial increase in the magnetic field dependence of the Hall coefficient in both n- and p-type Si may be related to the multiple ionization or to radiation annealing. The Hall mobility and transverse magnetoresistance in n-type Ga arsenide have been studied as a function of impurity concentration and density of defects introduced by fast-neutron irradiation. The change in the mobility and magnetoresistance with fast-neutron bombardment suggests the introduction of levels near the band edges and of multiply ionized levels similar to those in Si. ***R. K. Willardson.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1158-1165.

12849 Recombination Properties of Bombardment Defects in Semiconductors. The theory of recombination via defects having energy levels in the forbidden gap is reviewed. Emphasis is given to those aspects which complicate interpretation of lifetime data, such as the inherent difference between steady state and transient measurements, large-signal behavior, competing recombination mechanisms, trapping, the possible existence of strongly temperature-dependent cross sections, and the properties of multilevel defects. A summary of the known recombination properties of bombardment-produced defects is given. ***G. K. Wertheim.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1166-1174.

12850 Radiation Effects on Recombination in Germanium. The properties of recombination centers in Ge are obtained on the basis of lifetime data in conjunction with other information available. For recombination centers introduced by Co^{60} gamma rays and fission neutrons, the recombination energy level position is placed at 0.20 ev below the conduction band. The room temperature hole-capture cross sections resulting are 1.1×10^{-15}cm^2 and 6×10^{-15}cm^2 for Co^{60} gamma-ray and fission neutron irradiation, respectively. ***Orlie L. Curtis, Jr.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1174-1180.

12851 Electron-Bombardment Induced Recombination Centers in Germanium. The rate of change of minority carrier lifetime in Ge crystals bombarded by 1-Mev electrons has been studied experimentally as a function of the initial resistivity of the material. Analysis of the data leads to the conclusion that a single recombination center controls lifetime in both n- and p-type material, that this level is located at either 0.21 ± 0.005 ev from the conduction band or else at 0.26 ± 0.005 ev from the valence band, and that the ratio of the cross section for capture of minority holes is 18 times the cross section for capture of minority electrons. The absolute value of the hole capture cross section is 4.5×10^{-15} cm^2 if one uses the best available data for the probability of producing a Frenkel defect by a 1-Mev electron. This large value is compared to the findings of other authors in similar experiments. ***J. J. Loferski and P. Rappaport.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1181-1183.

12852 Nature of Bombardment Damage and Energy Levels in Semiconductors. The different effects of Co^{60} gamma-ray and fast neutron bombardment on the electrical behavior of Ge are discussed in terms of different local distributions of lattice defects expected for these two types of radiation. ***J. H. Crawford, Jr. and J. W. Cleland.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1204-1213.

12853 Disordered Regions in Semiconductors Bombarded by Fast Neutrons. The width and depth of the potential wells surrounding disordered regions in neutron irradiated *n*-type Ge and extrinsic Si are estimated. Numerical examples of well dimensions for a wide range of sample characteristics are presented. Some effects of disordered regions, e.g., (a) scattering of conduction electrons, (b) absorption of holes, and (c) polarizability, are discussed. ***B. R. Gossick.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1214-1218.

12854 Transistors . . . Their Industrial Impact. Transistor electronics is but the vigorous leader of the broader field of solid-state electronics to come. Some of the newer knowledge of the physics and metallurgy of ferromagnetic, ferroelectric, electroluminescent, and cryogenic materials is already being developed into new technologically significant devices. ***J. A. Morton.*** *Journal of Metals*, v. 11, Aug. 1959, p. 502-505.

12855* Printed Circuit Radiators. The Sandwich Wire Antenna. A new microwave line source configuration consists basically of three continuous coplanar conductors. The two outer conductors, parallel to each other, are at ground potential; the excited center conductor is bent into sinusoidal form, with a period equal to the wavelength. The polarization is transverse to the length of the array. ***Walter Rotman and Nicholas Karas.*** *Microwave Journal*, v. 2, Aug. 1959, p. 29-33.

12856* Low Frequency Prototype Backward-Wave Reactance Amplifier. A theory describing the operation of a backward-wave reactance amplifier has been worked out, and a low-frequency prototype constructed. This amplifier has a low noise figure and a narrow amplification bandwidth that can be rapidly turned over a wide frequency range. ***D. I. Breitzer and E. W. Sard.*** *Microwave Journal*, v. 2, Aug. 1959, p. 34-37.

12857* The Design of Multi-Hole Coupling Arrays. The methods for designing multi-hole directional couplers employing arrays of round coupling holes located in either the common narrow walls or broad walls of two suitably joined waveguides are described. The equation for each coupling configuration is given so that calculation of the hole sizes can be made for any size waveguide at any frequency in the fundamental mode. ***Edward S. Hensperger.*** *Microwave Journal*, v. 2, Aug. 1959, p. 38-42.

12858 Zener Diode Circuit Applications. ***L. H. Dunklee.*** *Military Electronics*, v. 7, Aug. 1959, p. 19-21.

12859* Military Handbook. Electron Tubes, Techniques for Application of Military Equipment. 684 pp. 1958. Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. (TK7872.V3 Un3.2m Ref.)

12860* Calculation of Sweep Characteristics of a pnp-npn Combination. A pn pn junction transistor could be imagined as consisting of two pnp-npn junction transistors connected in a convenient manner. The pnp-npn-combination is investigated with regard to the manifold possibilities for use of negative voltage-current characteristics, and to its physical simplicity. (*In German.*) Berechnung der Kippkennlinien einer pnp-npn-Kombination. ***K. Leberwurst.*** *Nachrichtentechnik*, v. 9, no. 6, 1959, p. 246-253.

12861* Four-Pole Locus Diagrams of the Transistor as a Basis for Calculations of Circuits. The transistor is considered departing from the theory of four terminal networks. The first part leads to variables which seem to be most convenient for the shape of locus diagrams and for the measurement. In the second part, the results obtained are used in order to calculate a simple amplifier circuit. Part three deals with an abbreviated method for the numerical determination of parameters. (*In German.*) Vierpolortskurven des Transistors als Berechnungsmittel für Schaltungen. ***H. Rohr.*** *Nachrichtentechnik*, v. 9, no. 6, 1959, p. 253-260.

12862* Gain-Controlled Transistors. From the characteristics of transistors in the grounded emitter circuit, three possibilities for control are derived: (1) Control within the range of low base currents. (2) Control within the range of low collector voltages. (3) Control within the range of high base currents. The h_{21} and all other parameters are considered as a function of the working point. (*In German.*) Der geregelte Transistor. ***L. Steinke.*** *Nachrichtentechnik*, v. 9, no. 6, 1959, p. 261-264.

12863 Impurity Scattering in Superconductors. With the Bardeen-Cooper-Schrieffer theory as a starting point, perturbation theory is used to determine the reduction in superconducting transition temperature due to scattering by impurities dissolved in the superconductor. Two cases are discussed: scattering due to a localized exchange interaction between the spins of the conduction electrons and impurity spins, and purely orbital scattering by nonmagnetic impurities. In the former case, good quantitative agreement with observations is obtained. In the latter case numerical agreement is less good, but the qualitative feature, that the initial reduction in T_c is a universal function of residual resistivity is made evident. It is further shown that indiscriminate application of perturbation theory of B.C.S. states leads to the wrong result in predicting the transition temperature, if the transition is of second order. ***H. Suhl and B. T. Matthias.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 977-988.

12864 Polarization of the Electron Gas in Metals by Substitutional Impurities. The ground-state energy of the system of impurities and conduction electrons in a metal has been obtained in the high electron density limit. The procedure used is an extension of the Wentzel method applied to a reduced Hamiltonian which includes an electron-impurity interaction. It is reduced in the sense that the Coulomb interaction between electrons and the electron-impurity interaction is only effective in raising an electron in a state below the Fermi level to one above and vice versa. The ground-state energy is then obtained by a canonical transformation. ***B. D. Silverman and P. R. Weiss.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 989-994.

12865 Lifetimes and Capture Cross Sections in Gold-Doped Silicon. The free lifetimes of electrons and holes in gold-doped Si were determined by applying an electric field and measuring the amplitude of the pulses produced by α-particles. Knowing the impurity concentrations and assuming that the lifetime is determined primarily by capture at the gold-sites, the cross sections for capture were calculated. The value for either electrons or holes at neutral gold sites is 2×10^{-15} cm^2 and at oppositely-charged sites, 1×10^{-13} cm^2. ***W. D. Davis.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1006-1008.

12866 The Properties, Physics, and Design of Semiconductor Devices. Part I covers the nature, properties, behavior and uses of semiconductor devices including thermistors, varistors, photoelectric cells, and transistors. Part II is concerned with band theory of solids, conduction mechanisms, hole and electron statistics, continuity equations for excess minority carrier concentrations, p-n junction theory, contact theory, junction triode theory, optical properties and photoelectric effects; thermoelectric effects and the Hall effect; and device fabrication technology. ***John N. Shive.*** 487 pp. 1959. D. Van Nostrand Co., Princeton, N. J. (QC611 Sh69p.)

12867 Solid State Magnetic and Dielectric Devices. Begins with a classical treatment of magnetization and polarization, and later shows the general application of these principles to electrochemical phenomena, to square loop material, and to microwave frequencies. ***H. W. Katz, editor.*** 536 pp. 1959. John Wiley & Sons, New York. (TK7870 K15s)

12868* Cold Cathode Tubes and Their Multiple Applicabilities. Cold cathode tubes, also called relay tubes or cold cathode thyratrons, are gaining more and more in importance. The rapid development of these tubes within the last few years is based on the final solution of a number of design problems and on the use of the so called "pure metal" cathode. (*In German.*) Kaltkathodenröhren und ihre vielfältigen Anwendungsmöglichkeiten. ***Roland Hübner.*** *Vakuum-Technik*, v. 8, no. 5, July 1959, p. 123-127.

See also: **12443** (aircraft control display system); **12817** (inorganic semiconductors); **13283** (semiconductor precipitation); **13464** (high-temperature transistors).

ENGINEERING ECONOMICS

12869* Capital Spending Trend: Fewer New Plants, More Modernization? Westinghouse will invest as much to modernize old plants as to construct new ones. *American Machinist*, v. 103, Aug. 10, 1959, p. 93.

12870* Meeting Japan's New Import Challenge. Low production costs allow Japan to sell products at prices nearly irresistible to U. S. consumers. ***Kurt Barnard.*** *Dun's Review and Modern Industry*, v. 74, no. 2, Aug. 1959, p. 33-35.

12871 Economics of the Mineral Industries. This volume is addressed primarily to those who are anxious to obtain a general education in the field. This does not mean that it cannot and will not be used by operators, consulting mining engineers, entrepreneurs, financiers, federal and state legislators, administrators, and jurists. Their needs, however, will usually be for information on a single phase of mineral economics. Geographically, the principal emphasis is on the United States, but numerous references are made to foreign countries. ***Edward H. Robie, editor.*** 55 pp. 1959. The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York. (HD9506 R55e)

12872 Minerals in Man's Future. After making certain assumptions about man's status in the future, the author predicts progress and changes in the economic use of minerals. With the advent of nucleonics, man has suddenly found himself with hundreds of new tools so potent in his quest for advancement that his imagination is wholly inadequate to cope with the possibilities. Instead of some ninety elements as basic "building blocks", there are now hundreds of isotopes, some stable and some radioactive, to use for development of science and to utilize for man's needs. Even the new elements, such as Pu, offer potentialities beyond one's ability to appraise. These new elements and most of the isotopes are either minerals, or derive from minerals, or could not be made available to man without the generous use of mineral products. Here is sufficient challenge to man to provide him with incentive to progress for the indefinite future. ***Zay Jeffries.*** Paper from "Economics of the Mineral Industries", p. 733-744, 1959. The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York. (HD9506 R55e)

12873* Building Dollars Head for Europe. The 1958-60 plans of U. S. manufacturers, from a McGraw-Hill survey. *Engineering News-Record*, v. 163, no. 7, Aug. 13, 1959, p. 21-23.

12874* Work Measurement. How work measurement started, how it looks today, and where it is headed. ***Mike Maynard.*** *Factory*, v. 117, Aug. 1959, p. 60-67.

12875* Focusing on Costs. Here's how Armco bags big dividends on costs—cuts time, improves quality, boosts output. *Factory*, v. 117, Aug. 1959, p. 80-83.

12876 Federal Budget and Fiscal Policy 1789-1958. A review of the prevailing views that dictated policy from 1789 to the 1930's, and of the remarkable change in attitude that emerged after 1932 and led to the concept of pump priming, compensatory fiscal policy, and the assumption by government of responsibility for economic growth and cyclical stability. ***Lewis H. Kimmel.*** 1959. The Brookings Institution, Washington, D. C. (HJ2050 K57f)

12877 Freedom of Entry Into Industry and Trade. Surveys the various aspects of the problem of freedom of entry into industry and trade and to discuss relationship between freedom of entry and productivity. The author investigates different types of entry in establishment of new firms, transfer, succession or extension of existing firms, and implications on economy. ***Preben Munthe.*** 76 pp. 1958. The European Productivity Agency of The Organisation for European Economic Co-operation, Paris. (HD2731 M92f)

12878* Blasting a New Product Into Orbit. Promotion of P. R. Mallory's new Si rectifier line boosted its production and sales 250%. ***Robert V. Cummins.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 46-48.

12879* Yale Presents the Big Lift in a Big Way. Here's the story of an intricately planned, timed, and executed promotion program which solved for Yale Materials Handling a nearly unique problem — how to promote a whole raft of new products at the same time and give each feature treatment. ***Newcombe C. Baker.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 52-70.

12880* Congress Ponders 'Territorial Security'. A battle over "fair trade pricing" is shaping up in Washington. Its outcome could have far-reaching effects on industrial selling. Here are the details. ***Stanley E. Cohen.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 104 + 3 pages.

12881* The Production of Values Added by Marketing. As our industrial productivity is stepped up through automation and other technological advances, those engaged in distribution must equate this challenge with development of effective marketing techniques. ***Al N. Seares.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 280-285.

12882* Controlling Raw Material Inventories. California Ink Co. finds Remington Rand Kardex system provides tighter internal controls, better inventory records, more economic ordering, and savings in paper work. *Paint and Varnish Production*, v. 49, no. 9, Aug. 1959, p. 67-69.

12883 Where Will Energy Come From in 2059. Forecast of supply and demand of petroleum and other energy sources through the coming century. ***Lewis G. Weeks.*** *Petroleum Engineer*, v. 31, Aug. 1959, p. A24-A31.

12884 Ten Ways Effective Inventory Control Can Benefit You. *Steel*, v. 145, Aug. 17, 1959, p. 58-59.

12885 Standardization Trims Material Purchasing Costs. Material standardization can help beat the cost crisis. It did for these two companies. Here's how they got their savings through more efficient purchasing. *Steel*, v. 145, Aug. 17, 1959, p. 98-99.

12886 Thermal Energy—System Planning. Despite the emergence of nuclear energy, the methods of converting fossil fuels into cheap electric power is a matter of importance to all nations of the world. Discusses economic and technical aspects of these methods. ***R. E. Tweeddale and W. K. Carruthers.*** Paper from "World Power Conference. Canadian Sectional Meeting". General Reports Division 1, Section B, p. 1-14. 1958. World Power Conference, Montreal, Canada. (TJ5 W89g.)

See also: **12424** (military airframe industry); **12724** (mineral fillers market); **13007** (promotional material).

FLUID MECHANICS

12887 Aerothermodynamic and Electrical Properties of Some Gas Mixtures to Mach 20. ***W. Chinitz, C. L. Eisen, and R. A. Gross.*** *ARS Journal*, v. 29, Aug. 1959, p. 573-579.

12888 An Experimental and Analytical Study of Vortex-Flow Temperature Separation by Superposition of Spiral and Axial Flows. I.-II. Experimental and analytical study of compressible flow in a uniflow vortex tube. ***J. E. Lay.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 81, no. 3, Aug. 1959, p. 202-222.

12889* A Method for Measuring the Dynamic Viscosity and Dynamic Rigidity of Visco-Elastic Liquids. II. Calculations; a diagram and a table are cited. ***Ali Abdel-Kerim Ibrahim.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 10, no. 1, 1959, p. 111-114.

12890* The Theory of Jet Atomization. Shows that the decomposition into drops at the jet is caused mainly by the intensive low-frequency turbulent pulsation acting as an internal force on the one hand, and the incidental dynamic power,

arising on the front surface of the moving drops, as an external force on the other hand. (*In German.*) Beitrag zur theorie der strahlzerstäubung. ***Gy. Sitkei.*** *Acta Technica, Academiae Scientiarum Hungaricae,* v. 25, nos. 1/2, 1959, p. 87-117.

12891* Heat Transfer to Laminar Flow Between Parallel Plates With a Prescribed Wall Heat Flux. The first three eigenvalues and constants, as well as asymptotic expressions for these quantities, are presented for heat transfer to laminar flow between parallel flat plates with a symmetrically prescribed wall heat flux. ***R. D. Cess and E. C. Shaffer.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods,* v. 8, no. 5, 1959, p. 339-344.

12892* Approximate Subsonic Gas Flows Under Assigned Boundary Conditions. Shows that Schwarz's results on minimal surfaces can be immediately applied for two-dimensional flow, and several special cases and examples are given. Extensions of these results provide certain particular types of three-dimensional flow. ***G. Power and P. Smith.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods,* v. 8, no. 5, 1959, p. 349-356.

12893* The Growth of the Thermal Boundary Layer in Laminar Flow Between Parallel Flat Plates. Instead of separating variables, the energy equation is solved, after transformation, in the form of a power series. Supplies information concerning the initial growth of the thermal boundary layer which is not obtainable by previous methods using eigenfunction expansions. ***A. McD. Mercer.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods,* v. 8, no. 5, 1959, p. 357-365.

12894* Application of a Reciprocal Property to Subsonic Flow. To each flow pattern there corresponds a certain pressure density law. Using this property, an approximation method for subsonic flow is deduced, and an example is given which indicates that satisfactorily accurate results can be achieved. ***G. Power and P. Smith.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods,* v. 8, no. 5, 1959, p. 386-392.

12895 Fundamental Aspects of Solids-Gas Flow. I. Introductory Concepts and Idealized Sphere Motion in Viscous Regime. Introduces analytical and critical literature surveys which deal first with the individual fundamental momentum transfer phenomena associated with particulate motion as affected by particle shape, roughness, acceleration, concentration and rotation, as well as the turbulence characteristics and boundary conditions of the transporting fluid. ***L. B. Torobin and W. H. Gauvin.*** *Canadian Journal of Chemical Engineering,* v. 37, no. 4, Aug. 1959, p. 129-141.

12896 How to Handle Unusual Flow. Special methods relate energy requirements, rate of flow and conduit dimensions for compressible fluid flow and flow in complex piping. ***Jesse Coates and Bernard S. Pressburg.*** *Chemical Engineering,* v. 66, Aug. 10, 1959, p. 131-136.

12897 For Laminar Pipeline Flow of Bingham Plastics . . . Use Chart to Find Friction Factors. Graphical representation of the Buckingham equation in terms of a modified Reynolds number and yield number permits quick and accurate evaluation of the friction factors. ***G. W. Govier.*** *Chemical Engineering,* v. 66, Aug. 24, 1959, p. 139 + 2 pages.

12898* Theory and Practice of Fluo-Liquid Suspensions. Fluo-liquid beds are suitable for dedusting, cooling, and saturating gases, for separating liquid fogs, and for scrubbing gases containing gaseous impurities. (*In French.*) La théorie et la pratique des suspensions fluo-liquides. ***W. Muhlrad.*** *Chemie & Industrie (Génie Chimique),* v. 81, no. 6, June 1959, p. 165-177.

12899* An Example of Calculation of Harbor Waves by Interactions of Second Order. (*In French.*) Un exemple de calcul d'une seiche portuaire d'interaction de second ordre. ***Kenzo Takano.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 249, no. 2, July 15, 1959, p. 222-223.

12900 Heat Transfer Coefficients Between Fluid Jets and Normal Surfaces. Point coefficients of heat transfer which do not agree with those predicted by fluid mechanics theory are accounted for by an unusual flow pattern. ***J. M. F. Vickers.*** *Industrial and Engineering Chemistry,* v. 51, Aug. 1959, p. 967-972.

12901 Measurement of Dynamic Surface Tensions of Aqueous Solutions by the Falling Meniscus Method. II. ***Raymond Defay and Jacques R. Hommelen.*** *Journal of Colloid Science,* v. 14, no. 4, Aug. 1959, p. 401-410.

12902* Moment Characteristics of Profiles. If the function $v_{oo}(\mu)$ in a certain extension of the angles of attack can be replaced by a straight line, then by changing the position of the pivot axis of the profile, the moment with an increase can be enlarged, decreased, or can remain constant. The law of the moment change governing the blade can be obtained by means of the corresponding arrangement of the pivot axis. (*In Russian.*) Momentnye kharakteristiki profileĭ. ***G. V. Vigtorov.*** *Nauchnye Doklady Vysshei Shkoly, Energetika,* 1959, no. 1, p. 221-234.

12903* The Ultrasonic Flowmeter. Principles of operation of several flowmeters are reviewed. ***R. E. Fischbacher.*** *Society of Instrument Technology, Transactions,* v. 11, no. 2, June 1959, p. 114-119.

12904* Mass Flowmeters. ***P. Scanes.*** *Society of Instrument Technology, Transactions,* v. 11, no. 2, June 1959, p. 119-123.

See also: **12581** (magnetic flowmeter); **12582** (electronic propeller flowmeters); **13065** (fluid flow models).

FOOD TECHNOLOGY

12905 Antibiotics, Their Chemistry and Non-Medical Uses. Reviews chemistry of antibiotics and their use in nutrition and plant disease control. Also discusses applications of food preservation. ***Herbert S. Goldberg, editor.*** 608 pp. 1959. D. Van Nostrand Co., New York. (QD375 G56a)

12906* Potential Pathways in Nutritional Progress. A forecast of future research fields. ***Samuel Lepkovsky.*** *Food Technology,* v. 13, Aug. 1959, p. 421-424.

12907* Debittering of Grapefruit Products With Naringinase. Conditions of optimum enzymatic hydrolysis of naringin in grapefruit pulp and juice to less bitter substances, prunin and naringenin, are 50 C, pH 3.1 enzyme concentrations of .05-.01% and incubation periods of 1 to 4 hours. Prior inactivation of pectinesterase naturally present in juice before naringinase treatment is necessary to retain natural cloud. ***Francis P. Griffiths and Bruce J. Lime.*** *Food Technology,* v. 13, Aug. 1959, p. 430-433.

12908* Freestone Peaches. I. Effect of Sucrose, Citric Acid and Corn Syrup on Consumer Acceptance. Optimum sweetness in the all-sucrose pack was found to be approximately 22.5° Brix, and acidification did not improve flavor. At an ingoing syrup of 40° Brix, the all-sucrose control received significantly higher consumer preferences than did the corn-syrup containing samples. However, at 50° Brix, the samples received equal consumer acceptance. Trained laboratory tasters indicated a significant decrease in fruit flavor and an increase in off-flavor with increasing replacement by corn syrup at the 40° Brix level. ***Rose Marie Pangborn, Sherman Leonard, Marion Simone, and Bor S. Luh.*** *Food Technology,* v. 13, Aug. 1959, p. 444-447.

12909 Laboratory Manual for Food Microbiology. ***W. C. Frazier and E. M. Foster.*** 3rd Ed. 131 pp. 1959. Burgess Publishing Co., Minneapolis, Minn. (QR115 F86L3)

See also: **12506** (microbiology text book); **13594** (yeast from spent sulfite liquor).

FUELS AND COMBUSTION

12910 Graphical Computation of Shock and Detonation Waves in Real Gases. ***George H. Markstein.*** *ARS Journal*, v. 29, Aug. 1959, p. 588-590.

12911 Coal-Ash Slags. II. Flow Properties. Concerns principally the flow properties of coal-ash slags and the means by which they are assessed. ***J. T. Shaw.*** *British Coal Utilisation Research Association, Monthly Bulletin*, v. 32, May 1959, p. 170-190.

12912 Pipeline Gas From Char Via the Lurgi Process. Process is described. Capital investment and operating costs are discussed. ***Sidney Katell, John H. Faber, and Marc T. Constantine.*** *Coal Age*, v. 64, Aug. 1959, p. 92-95.

12913* Combustion of Crushed, Dried Texas Lignite and Char in Steam-Power Boilers. Describes how the problems of handling, feeding, and transporting these process fuels were met. ***V. Z. Caracristi and H. D. Mumper.*** *Combustion*, v. 31, no. 1, July 1959, p. 34-44.

12914* Spray Combustion Theory. The burning-rate eigenvalue problem for one-dimensional heterogeneous combustion processes of the type A⟶nB is formulated, and an analysis for sprays composed of uniform droplets illustrates the properties of the eigenvalue. An approximate analytical solution for the burning velocity is shown to be in numerical agreement with experiments on tetralin. ***F. A. Williams.*** *Combustion and Flame*, v. 3, no. 2, June 1959, p. 215-228.

12915* Smokeless Combustion System. Claims to achieve over 99 per cent combustion efficiency and the elimination of smoke and CO by a double combustion process. *Engineer*, v. 208, July 31, 1959, p. 39.

12916 How Automobile Exhaust Gases Burn. An Approach to Air Pollution Control. Feasibility of reducing atmospheric pollutants by using noncatalytic afterburners for automobiles depends on maintenance of a flame in the engine exhaust gases. ***Bernard Greifer and Raymond Friedman.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 953-956.

12917 The Tensile Strength of Coal. Methods of measurement. ***R. Berenbaum and I. Brodie.*** *Institute of Fuel, Journal*, v. 32, July 1959, p. 320-327 + 2 plates.

12918 Comparison of Different Methods of Fluid-Atomizing Oil Flames and the Effect on Flame Emissivity and Radiation of the Addition of Carbon Black to Liquid Fuels. I. Comparison of Different Methods of Fluid-Atomizing Oil Flames. II. The Effect on Flame Emissivity and Radiation of the Addition of Carbon Black to Liquid Fuels. ***E. H. Hubbard.*** *Institute of Fuel, Journal*, v. 32, July 1959, p. 328-343.

12919 Utilization of By-Product Fuels. The use of blast furnace and coke-oven gases as boiler and coke-oven fuels, of coke-oven gas as an open hearth fuel, and potential use of blast furnace gas as fuel in gas turbines for blast furnace blowers driving will help conserve dwindling coal supplies and reduce steelmaking costs. ***R. W. Worley and R. H. Gherst.*** *Iron and Steel Engineer*, v. 36, Aug. 1959, p. 67-71.

12920 Where Are We Going in Fuel Handling? The cryogenic engineer still must be a jack-of-all-trades with industry having to gear up for multi-million-pound thrust boosters. ***S. David Pursglove.*** *Missiles and Rockets*, v. 5, no. 32, Aug. 3, 1959, p. 28-30.

12921* The Purification of Heavy Oil. A summary of the principal findings of a project based on earlier tests in the Sulzer laboratories. ***Alfred Brunner.*** *Sulzer Technical Review*, v. 40, no. 4, 1958, p. 47-57.

12922 Symposium on Stability of Distillate Fuel Oils. Great advances have been made through improved refining and treating processes and increased use of additives. Presents eight papers on this topic. 56 pp. 1959. American Society for Testing Materials, Philadelphia. (TP355 Am35ss)

12923 Research and Technologic Work on Coal and Related Investigations, 1956. Origin and properties, exploration and development; storage; carbonization and its products; metallurgical uses of coal. *U. S. Bureau of Mines Information Circular* 7904, 1959, 112 pp. (TN21 Un3i Vis.)

12924 Research and Technologic Work on Coal and Related Investigations, 1957. Origin and properties of coal; exploration and mining; storage and preparation; gasification. *U. S. Bureau of Mines Information Circular* 7905, 1959, 85 pp. (TN21 Un3i Vis.)

See also: **12988** (gas turbine progress report).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

12925 Meteoric Ablation Through Interfacial Instability. Taylor-type interfacial instability of the molten layer on the surface of a meteoric body is analyzed when the representative situation on the surface of a blunt nosed body is taken into consideration. ***Sin-I Cheng.*** *ARS Journal*, v. 29, Aug. 1959, p. 579-587.

12926 Amateur Astronomer's Handbook. Telescopic functions: lightgrasp, resolution, magnification and field size, aberrations, types of object glass, optical materials, metal-on-glass films, oculars, compound optical instruments, the mounting of the optical parts, dewing-up and tube currents, Newtonian and Cassegrain adjustments, testing, mountings, telescope drives, and other subjects are discussed. ***J. B. Sidgwick.*** 580 pp. 1954. Faber and Faber, London. (QB44 Si13a)

12927* Long-Range Weather Forecasting in the Soviet Union. Developments are described and evaluated. ***Werner A. Baum and Philip D. Thompson.*** *American Meteorological Society, Bulletin*, v. 40, Aug. 1959, p. 394-409.

12928* Synchronous Highs: Preferential Habitat of Oil? "Hills" on the sea floor present during sedimentation tend to create conditions favorable to all three stages in the natural history of petroleum—origin, migration, accumulation—and are therefore thought to represent preferential habitats of oil and gas. ***Robert Scholten.*** *American Association of Petroleum Geologists, Bulletin*, v. 43, Aug. 1959, p. 1793-1834.

12929* Origin of Salt Anticlines of Paradox Basin. Evidence supports the idea that the anticlines were initiated by the differential loading of the salt-bearing Pennsylvanian Hermosa formation by the Permian Cutler formation. ***R. W. Jones.*** *American Association of Petroleum Geologists, Bulletin*, v. 43, Aug. 1959, p. 1869-1895.

12930* The Histories of the International Polar Years and the Inception and Development of the International Geophysical Year. (*In English and French.*) *Annals of the International Geophysical Year*, v. I, pts. I, II, and III, 1959, 446 pages.

12931 Applications of the Chloride Reagent Film. ***N. H. Farlow.*** Paper from "Atmospheric Chemistry of Chlorine and Sulfur Compounds. Proceedings of a Symposium Held at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, November 4-6, 1957", American Geophysical Union of the National Academy of Sciences, Washington, D. C. 1959, p. 11-17. (TD884 Am35.3a)

12932 Transport of SO_2 in the Atmosphere From a Single Source. Presents a summary of some preliminary findings in estimating stack-gas dispersion from power plants the size and type of TVA plants and describes a full-scale diffusion study just being initiated. ***F. E. Gartrell, F. W. Thomas, and S. B. Carpenter.*** Paper from "Atmospheric Chemistry of Chlorine and Sulfur Compounds. Proceedings of a Symposium Held at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, November 4-6, 1957", American Geophysical Union of the National Academy of Sciences, Washington, D. C. 1959, p. 63-68. (TD884 Am35.3a)

12933 Artificial Cloud Nucleation With Sodium Chloride. The role of giant hygroscopic nuclei in rain formation; geographical distribution of giant hygroscopic nuclei; and techniques of seeding with artificial hygroscopic particles. ***E. M. Fournier d'Albe.*** Paper from "Atmospheric Chemistry of Chlorine and Sulfur Compounds. Proceedings of a Symposium Held at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, November 4-6, 1957, "American Geophysical Union of the National Academy of Sciences, Washington, D. C. 1959, p. 106-110. ((TD884 Am35.3a)

12934 On the Geochemistry of Chloride and Sulfate. ***Erik Eriksson.*** Paper from "Atmospheric Chemistry of Chlorine and Sulfur Compounds. Proceedings of a Symposium Held at the Robert A. Taft Sanitary Engineering Center. Cincinnati. Ohio, November 4-6, 1957", American Geophysical Union of the National Academy of Sciences, Washington, D. C. 1959, p. 124-127. (TD884 Am35.3a)

12935* Dust Control at an Underground Loading Station. ***J. R. Hall.*** *Canadian Mining Journal*, v. 80, Aug. 1959, p. 69-71.

12936* Safe-Guarding Air Conditions for Trackless Mining at Gaspé Copper Mines. ***Peter Stym.*** *Canadian Mining Journal*, v. 80, Aug. 1959, p. 80-87.

12937* Dust Control in Uranium, Copper and Taconite Processing. Illustrates and discusses some dust collector designs. ***David E. Bonn.*** *Canadian Mining Journal*, v. 80, Aug. 1959, p. 87-92.

12938 Gemstones of North America. Comprehensive nontechnical descriptions of North American gem resources for the amateur, the student, the collector and connoisseur of gems. With color and black and white illustrations, it describes each gemstone species, and where and under what circumstances it is found. ***John Sinkankas.*** 675 pp. 1959. D. Van Nostrand Company, Inc., New York. (QE392 Si65g)

12939* Types of Cement and Their Effect on the Penetrability of Sandy Rocks. Discusses rocks and their porosity. Some tables and sketches are cited. (*In Russian.*) Tipy tsementa i vliianie ikh na pronitsaemost' peschanykh porod. ***N. V. Smirnova.*** *Geologiia Nefti i Gaza*, v. 3, no. 7, June 1959, p. 33-39.

12940* Weather Modification and Smog. I. An analysis of current proposals. ***M. Neiburger.*** *Industrial Wastes*, v. 4, no. 4, July 1959, p. 61-65.

12941 Symposium on Geophysics in Kansas. A collection of 25 solicited papers from individuals, industries, and governmental agencies known to have participated in geophysical studies in Kansas, published as an activity of the International Geophysical Year. ***William W. Hambleton, editor.*** *Kansas. State Geological Survey Bulletin No.* 137, 1959, 375 pp. + 3 maps. (TN21 K13b Vis.)

12942* Anhydrous Chromic Chloride Production by Chlorination. ***R. L. Annis, et al.*** *Mines Magazine*, v. 49, Aug. 1959, p. 21-24.

12943* Principles of the Flow of Crushed Materials. Discusses failure of flow in crushed material. ***A. W. Jenike, P. J. Elsey, R. H. Woolley.*** *Mining Congress Journal*, v. 45, Aug. 1959, p. 73-75.

12944* Trends in the Application of Geophysics. A resumé of the actual situation of geophysics in mining—where, how, for what purposes, and at what costs—based on activity in Arizona. ***Walter E. Heinrichs, Jr.*** *Mining Engineering*, v. 11, July 1959, p. 688-690.

12945* Meteorological Influence on Radon Concentration in Drillholes. ***Allan B. Tanner.*** *Mining Engineering*, v. 11, July 1959, p. 706-708.

12946 Blasthole Mining at Geco. The Geco mine has developed from a prospect in virgin country to one of Canada's larger base metal mines. High efficiencies have resulted from good fragmentation and use of gravity movement of ore to crusher by the transfer raise system, followed by conveyor movement of ore to the shaft loading pocket. ***G. M. T. Marshall.*** *Mining Engineering*, v. 11, Aug. 1959, p. 797-802.

12947 Seismic Analysis Aids in Overburden Removal. *Mining Engineering*, v. 11, Aug. 1959, p. 803-804.

12948* Scenes in Ohio During the Last Ice Age. Discusses the conditions existing in Ohio during the last ice age. Uses today's ice caps to interpret and explain the effect of the ice on Ohio thousands of years ago. ***Richard P. Goldthwait.*** *Ohio Journal of Science*, v. 59, no. 4, July 1959, p. 193-216.

12949* New Rubber-Sleeve Core Barrel Gets Good Cores in Soft and Unconsolidated Formations. New barrel gets high percentage recovery and excellent-quality cores. As the cores are packaged in the rubber sleeve as they are cut, there is no flushing of the core by well fluids after cutting. ***B. L. Austin.*** *Oil and Gas Journal*, v. 57, no. 35, Aug. 24, 1959, p. 75-77.

12950* Radoil's Approach to Porosity-Trend Mapping. The Radoil method makes use of radio waves to disclose the electrical contrast that exists between oil and salt water, or between oil and sediments, at the boundaries of oil fields. ***William M. Barret.*** *Oil and Gas Journal*, v. 57, no. 35, Aug. 24, 1959, p. 120-124.

12951 Oil Well Drilling Technology. Rocks and fluids of oil and gas provinces; seismic exploration principles; drilling fluids; drilling practices. ***Arthur W. McCray and Frank W. Cole.*** 492 pp. 1959. University of Oklahoma Press, Norman. (TN871.2 M130)

12952* Exploration Methods and Prospects of the Zones of Pinch-Out Reservoirs of the Krasnodar Area. ***V. A. Grossgeim.*** *Petroleum Geology*, v. 2, no. 8/A, 1958, p. 699-706.

12953* Soviets Push Work on Retractable Bits. Experiments with rock bits to cut round-trip costs. *Petroleum Week*, v. 9, no. 7, Aug. 14, 1959, p. 25 + 3 pages.

12954 Physicochemical Basis of the Analysis of the Paragenesis of Minerals. The thermodynamic basis of the analysis of paragenesis of minerals, methods of representing chemical composition, the relation between chemical and mineralogical composition under constant external conditions, dependence of mineralogical composition on external conditions and general remarks on the application of paragenetic analysis of minerals in geology are discussed. (Translated from the Russian.) 142 pp. 1959. Consultants Bureau, New York. (QE364 K84ftr)

12955* Dowsing or Divining. A Sequel to "Fact or Fancy—Pipeline Divining Rods". Discusses the "mystic" business of divining rods for locating buried pipelines. Gives some scientific suggestions to explain one apparent success of the divining method. ***F. Vinton Long.*** *Pipe Line News*, v. 31, Aug. 1959, p. 36 + 4 pages.

12956 Study of the Cosmic-Ray Soft Component by the 3rd Soviet Earth Satellite. Measurements made with a scintillation counter installed on the 3rd Soviet earth satellite are presented. By this instrument, the counting rate corresponding to the energy greater than 35 keV and the total ionization in the scintillator were measured. Two zones of high intensity radiation are observed. ***S. N. Vernov, et al.*** *Planetary and Space Science*, v. 1, no. 2, Apr. 1959, p. 86-93.

12957 Absorption and Electron Distribution in the F_2 Layer Determined From Measurements of Transmitted Radio Signals From Earth Satellites. Comparison is made between measured field strengths of transmitted signals from earth satellites and those theoretically predicted when the transmitter position is in the region of maximum electron concentration of the F_2 layer, below it, and above it. ***A. N. Kazantsev.*** *Planetary and Space Science*, v. 1, no. 2, Apr. 1959, p. 130-135.

12958 The Quaternary Era With Special Reference to Its Glaciation. Comprehensive survey of geological developments during the period following the Pliocene era. ***J. K. Charlesworth.*** v. I-II. 591 and 1700 pp. 1957. Edward Arnold, Ltd., London. (QE696 C38q)

12959 Research Inspired by the Dutch Windmills. Lists investigations in the field of windmill design, from medieval times to the present; tests being made with large wind-driven drainage mills. Treats fundamental problems of aerodynamic and climatic nature relating to windmill design. 184 pp. H. Veenman en Zonen, Wageningen, Netherlands. (TJ825 P93r)

12960 Research in Space. A review. *Science*, v. 130, July 24, 1959, p. 195-202.

12961 Organic Compound Synthesis on the Primitive Earth. Answers several questions about the origin of life. ***Stanley L. Miller and Harold C. Urey.*** *Science*, v. 130, July 31, 1959, p. 245-251.

12962 Observations on Nickel-Bearing Cosmic Dust Collected in the Stratosphere. Samples collected from four balloon flights with plateau elevations between 77,000 and 112,000 feet indicate the deposition of 0.17 to 0.36 Ni-bearing particles per cm^2 per day of exposure. Gives details of the technique. ***Herman Yagoda.*** *U. S. Air Force, Cambridge Research Center, GRD Research Notes, No.* 9, Mar. 1959, 13 pp. (QC806 Un3.23g Contin.)

12963 Calibrating the Mark II Minitrack System With Radio Stars as Signal Sources. Shows that the tracking of radio stars provides an adequate system calibration if sufficient data are taken. ***V. R. Simas and G. C. Kronmiller, Jr.*** *U. S. Office of Naval Research. NRL Report* 5215, Oct. 17, 1958, 26 pp. (T21 Un3.5n Contin.)

12964 Proceedings of the Eighteenth Annual Appalachian Gas Measurement Short Course (1958.) Gas laws and related principles; orifice meters; meter testing. ***R. E. Hanna, Jr., editor.*** *West Virginia University, Technical Bulletin No.* 53, Jan. 1959, 486 pp. (TA21 W52t Contin.)

12965* Turbodrilling Progress and New Drilling Methods in the USSR. ***R. A. Ioannesyan, et al.*** *World Petroleum*, v. 30, Aug. 1959, p. 42-45.

12966* Automatic Drilling Weight Control. An automatic drilling weight control device, called the "Geodril", is a simple control device of the detachable type for use on any type rotary drilling rig. ***James O. Melton.*** *World Petroleum*, v. 30, Aug. 1959, p. 64.

See also: **12436** (structure of the outer atmosphere); **12871** (mineral industries economics); **12872** (minerals industry economics); **13466** (electromagnetic phenomena of the cosmos).

GRAPHIC ARTS

12967 Document Copying and Reproduction Processes. Surveys methods of reproduction from simple carbon copying to the minor offset and small typeset machines, including photocopying, direct positive and diazo methods, Verifax, Thermofax, Kalfax, Xerography, Electrofax, the hectographic process, stencil duplication, direct and offset lithiography, addressing machines, facsimile reproduction, plan-copying processes, silk screen and microfilm. ***H. R. Verry.*** 317 pp. 1958. Fountain Press, London. (Z48 V61d)

12968 The Effect of Rotogravure Cell Dimensions on Print Quality of Line Work and Solids. The print quality of line work and solids is a function of the depth, bridge width, number of lines per inch, and general shape of the etched rotogravure cells. Printed samples were evaluated on four points: ink lay, color density, fine type, and reverse type. Results of this evaluation are discussed. ***Robert V. Hershey.*** *Gravure*, v. 5, Aug. 1959, p. 12-16.

12969* Construction of a Schmidt Camera. ***S. L. Mallick.*** *Journal of Scientific & Industrial Research*, v. 18A, June 1959, p. 268-273.

12970* Direct-Reading Zero-to-Six Range Densitometer Incorporating Digital Output. To measure the high densities encountered in graphic arts and X-ray film products, the amplifier circuit of a commercially available direct-reading photomultiplier type of densitometer of range 3 was redesigned to provide a range of 6, preserving its original accuracy, electrically uniform output, high speed of response and other desirable functional features. Whereas the original densitometer utilizes constant anode current, in the present modification the anode current is deliberately varied by means of a controlled bias voltage and a nonlinear anode load resistance. A digital reader was developed to provide an accurate and easy to use output indicator for the densitometer. ***Monroe H. Sweet.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 97-100.

12971* Automatic Recording and Analyzing Densitometer for Reflection and Transmission Densities. An instrument is described that simultaneously records the densities and computes the desired sensitometric characteristic values of test strips accurately and reliably. The new instrument accommodates both reflection and transmisison strips on a 3 or 6 density range and does not require calibration or zero re-adjustment when changing ranges. Routine operation consists of feeding unmounted test strips into a slot in the measuring head. ***Monroe H. Sweet and Benjamin R. Harriman.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 101-109.

12972* A New Method for Evaluating Sensitometric D-Log E Curves. A method is presented whereby a given sensitometric curve is described as a modification of a universal standard curve. The method has been applied primarily to papers. In general, three quantities are expressed: speed, grade number, and maximum density, each of which is based on the characteristics of the whole curve. ***W. H. Carnahan.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 110-113.

12973* Some Observations on the Reproduction of Flesh Colors. The colors of a limited number of optimum or preferred pictorial reproductions of flesh colors are found to be significantly different from the actual color of average natural flesh, but have essentially the same hues and saturations as the mean abstract memory-color for flesh. ***C. J. Bartleson.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 114-117.

12974* Image Illuminance Levels in Night Photography. Factors which determine the image illuminance levels for night photography under various ambient conditions are discussed. Incident light levels alone are not sufficient to determine the amplification required at the plane of the photoamplifier. Scene brightness, lens aperture, haze, and lens flare factor must also be considered. Typical values of exposure input in meter-candle-seconds are computed for several types at $f/1.0$ and an exposure of 0.2 sec. ***William G. Cibula.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 118-121.

12975* Hypersensitization of X-Ray Films. The sensitivity of ordinary photographic emulsions to light can be increased by treatment with silver salt solutions such as silver nitrate or silver tungstate solutions. This treatment, however, was found to decrease the X-ray sensitivity of X-ray emulsions. The X-ray or γ-ray sensitivity of X-ray emulsions was increased by a treatment with thallium nitrate solutions, and the effect of hypersensitization was larger in the higher exposure region, so that the treatment increased the contrast of X-ray or γ-ray images. The Th hypersensitization also stabilized the latent images formed by X-rays and γ-rays. ***Yoshitada Tomoda.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 122-126.

12976* Effect of Derivatives of Thiourea and Related Compounds on Zeta-Potential of Silver Bromide. Electrophoretic behavior of silver bromide at pH 3 and 11 was studied with a sol prepared in the presence of excess bromide. The effects of 1-methylthiourea, 1,3-dimethylthiourea, and 1,1,3-trimethylthiourea were nearly the same as that previously reported for thiourea. Addition of a small quantity of any of these compounds to the acidic sol caused marked changes in the zeta-potential and the stability of the sol. Addition of a sufficient quantity changed the zeta potential from negative to positive. ***Shin Suzuki and Tooru Kataoka.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 127-131.

12977* Fungicidal Rinses for Processed Color Films. Techniques for the prevention of image deterioration due to fungus growth are discussed, with particular emphasis on fungicidal rinse treatments. The evaluation of a number of different aqueous rinses for their fungicidal activity is presented. ***E. S. Mackey and C. E. Johnson.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 132-134.

12978* Photographic Developing Agents: I. Pyrimidines. Developing properties were displayed by pyrimidines substituted by two or more adjacent amino and hydroxy groups. Further substitution by methyl groups or additional functional groups increased activity. The amino-substituted agents were more active than those containing only hydroxy groups, which were very pH-dependent. Activity was increased by combination with hydroquinone or 1-phenyl-3-pyrazolidone. However, the activity of the combinations was lower than that of Elon -hydroquinone, and they gave less emulsion speed and more fog. Two of the agents were oxidized with silver ammonium nitrate and found to form two atoms of silver per mole of developing agent. ***R. W. Henn and Sue V. Carpenter.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 135-139.

12979* The Calcium-Sequestering Properties of Organic Compounds in Photographic Developers. The quantity of calcium sulfite held in solution in a photographic developer is used as the means of measuring the relative sequestering power of 72 organic compounds of widely differing structures. Chelate rings are formed between a carboxy-, nitroso-, or nitro-primary group and an oxy-, hydoxy-, amino-, or olefinic-secondary group. Multiple chelation greatly enhances sequestration. Sulfonic acid groups show no activity, while mercapto groups are weak. These systems greatly increase the number of calcium-sequestering agents described, and have led to some practical photographic applications. ***R. W. Henn.*** *Photographic Science and Engineering*, v. 3, no. 3, May-June 1959, p. 140-144.

12980* Conditions for Projection Copying on Dye Cyanide Sensitized Materials. Measurements have been made of the order of contrast and printing speed that might be expected. The conclusion is reached that with a lens transmitting the ultraviolet region of 2800-3200 A and operating at f/4, projection prints could be made by exposures of a fraction of a minute by radiation from commercial Hg lamps. ***Lyman Chalkley.*** *Photographic Science and Engineering*, v. 3, no. 4, July-Aug. 1959, p. 174-177.

12981* Instrumentation for Cinemicrography. Functional requirements of instrumentation for cinemicrography are discussed. Flexible system based on commercially available units which would be interchangeable to meet the needs of any specific investigation of locomotion at microscopic levels is outlined. ***Arthur T. Brice.*** *Photographic Science and Engineering*, v. 3, no. 4, July-Aug. 1959, p. 186-191.

12982* Replaceable Objective Lenses in Microfilm Cameras. Different camera types are discussed and sketches are cited. (*In German.*) Auswechselbare Objektive für Kleinbild-Kameras. ***Egon Kellner.*** *Photo-Technik und-Wirtschaft*, v. 10, July 1959, p. 313-316.

12983* Ground Glass Focusing Screen or Rangefinder for Focusing? Advantages and disadvantages of both methods are discussed and sketches are cited. (*In German.*) Mattscheibe oder Entfernungsmesser zum Einstellen? ***Georg Franke.*** *Photo-Technik und-Wirtsschaft*, v. 10, July 1959, p. 316 + 3 pages.

12984* An Automatic Additive Color Printer. Solenoid-operated vane-type shutters in the printer control the red, green, and blue beams split up from the white light by dichroic mirrors. The color light values and the fader-speed information are fed into the printer by a perforated tape, which also starts and stops the printer. ***Hans-Christoph Wohlrab.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, July 1959, p. 479-481.

12985 Proceedings of the Third Annual Surveying and Mapping Conference. ***Clifford G. Bryner, compiler.*** *Utah Engineering Experiment Station, Bulletin No.* 97, Apr. 1959, 65 pp. (QE169 Ut1.82b Vis.)

See also: **13461** (photographic study of boiling); **13577** (air conditioning printing plants).

HEAT POWER

12986 Optimum Proportioning of Two Propellants to Obtain Maximum Burnt Velocity. Optimum performance results from a suitably programmed variation of propellant proportions throughout burning. Results applicable to the first stage of a rocket are presented. ***R. H. Olds.*** *ARS Journal*, v. 29, Aug. 1959, p. 598-601.

12987 Space Vehicle Power Systems. Open cycle, closed cycle chemically fueled power supply; closed cycle solar, closed solar cell, theromelectric power supply; and system comparisons. ***Eugene B. Zwick and Robert L. Zimmerman.*** *ARS Journal*, v. 29, Aug. 1959, p. 553-564.

12988 1958 Gas Turbine Progress Report. Consists of papers on materials, turbine cooling, fuels, cycle components, and compound piston- and turbine engines. Aviation, rocket turbines, automotive, railroad, marine, industrial and central station, and nuclear applications are studied. ***R. Tom Sawyer.*** *ASME, Transactions, Series A, Journal of Engineering for Power*, v. 81, no. 3, July 1959, p. 215-359.

12989* Hungarian Pioneers of the Gas Turbine. Outlines the activities of two pioneers of the gas turbine, Aladár Zsélyi and György Jendrassik. ***D. Brodszky.*** *Acta Technica Academiae Scientiarum Hungaricae*, v. 25, nos. 1/2, 1959, p. 63-85.

12990 Why Free Turbines? Discusses engine considerations common to solid-spool, twin spool, and free-turbine turboprops. ***D. P. Edkins.*** *Aero/Space Engineering*, v. 18, Aug. 1959, p. 58-63.

12991* Special Purpose Marine Propulsion Systems. I. Robert Taggart. *American Society of Naval Engineers, Journal*, v. 71, no. 3, Aug. 1959, p. 433-447.

12992* Fuel Cells. Discusses two basic types of fuel cells and describes some experimental work. Considers potential application of the fuel cell. ***Everett Gorin and Howard L. Recht.*** *American Society of Naval Engineers, Journal*, v. 71, no. 3, Aug. 1959, p. 449-452.

12993* Gas Turbines—Demonstrated Ability. Wide range of application, reasonable initial cost and low maintenance cost combined with power reliability will increase the rate of application of turbines in all fields. ***John W. Sawyer.*** *American Society of Naval Engineers, Journal*, v. 71, no. 3, Aug. 1959, p. 529-534.

12994* Review of Technical Progress in the Years 1957/8. An illustrated review divided into seven sections. *Brown Boveri Review*, v. 46, nos. 1/2, Jan.-Feb. 1959, 159 pp.

12995 Automatic Temperature Regulation of Internal Combustion Engine Cooling Systems. K. H. Müller. *Engineers' Digest*, v. 20, July 1959, p. 277 + 3 pages. (Translated from *Motortechnische Zeitschrift (M.T.Z.)*, v. 20, no. 5, May 1959, p. 137-142.)

12996 Gas Turbine Power. Includes material on free-piston gas turbines, gas turbine automobiles, and closed-cycle gas-turbine nuclear power reactors and added information on turbo-jet and the turboprop engines. ***George Merrick Dusinberre and John Campbell Lester.*** 2nd Ed. 334 pp. 1958. International Textbook Company, Scranton, Pa. (TJ778 D94g2)

12997* Solving Design Problems in a Diesel Powered Generating Plant for Peaking and Reserve Capacity. Applies knowledge and techniques used in several branches of engineering. The principal ones might be identified as: power generation and distribution, servomechanisms and electronics, mechanical and electro-mechanical systems, logical control design, instrumentation and metering, and test engineering. ***B. B. Brownell.*** *General Motors Engineering Journal*, v. 6, no. 3, July-Aug.-Sept. 1959, p. 19-26.

12998 Jets and Rockets. Momentum theory of jet and rocket propulsion, rocket motor, constructional details of typical bi-propellent rockets, rocket performance calculations, compressor and turbine of turbo-jet unit, turbo-jet combustion chamber, over-all performance of turbo-jet engine and propeller turbine, air intake, and jet of the aircraft are discussed. ***A. Barker.***

T. R. F. Nonweiler, and R. Smelt. 268 pp. 1959. Chapman & Hall Ltd., London. (TL709 B24j)

12999 Centaur Engine Tests Begin. General reports about present and future development are cited. ***Paul Means.*** *Missiles and Rockets*, v. 5, no. 32, Aug. 3, 1959, p. 20-21.

13000* The Instrumentation of Small Steam-Raising Plant. How boiler efficiencies on this type of plant can be improved by instrumentation. ***G. H. Perks.*** *Society of Instrument Technology, Transactions*, v. 11, no. 2, June 1959, p. 139-145.

13001 Space Propulsion. Hearings Before the Committee on Science and Astronautics, U. S. House of Representatives, Eighty-Sixth Congress, First Session. March 16-20, 23, 1959. Statements by 27 expert witnesses are presented. 307 pp. 1959. U. S. Government Printing Office, Washington, D. C. (TL782 Un3.237s)

13002* Supercritical Pressures and Efficiency of Steam Power Plants. A study of the dependence of plant efficiency on the live-steam pressure, as calculated for three projects representing an extract from an extensive program of investigations conducted on this problem. ***P. Profos.*** *Sulzer Technical Review*, v. 40, no. 4, 1958, p. 10-18.

13003* Research Reveals Performance of Unusual Turbine That Obtains Its Power From Fluid Friction. This extremely simple Tesla turbine claims production of 30 hp. at 20,000 rpm from a 10 lb. motor. ***Bass Redd and Lado Muhlstein, Jr.*** *Texas Engineering Experiment Station News*, v. 10, no. 2, June 1959, p. 3-4.

13004 World Power Conference. Canadian Sectional Meeting. General Reports Division 1-3 Section A-J. A general review of power resources and utilization. ***G. Ross Lord, Reporter.*** Sections individually paged. 1958. World Power Conference, Montreal, Canada. (TJ5 W89g)

13005 World Power Conference, Canadian Sectional Meeting, Sections A-J. Three volumes of papers delivered Sept. 7-11, 1958, at Montreal, Canada. (*In English and French.*) Papers individually paged. 1958. World Power Conference, Montreal, Canada. (TJ5, W89p Sections A, B, and C-J.)

See also: **12883** (energy forecast); **12959** (Dutch windmills); **13039** (heat and mass transfer), **13091** (corrosion of condenser and heat-exchanger tubes).

INFORMATION—PREPARATION AND DISSEMINATION

13006* A Basic Guide to Engineering Handbooks. Gives a picture of the planning, development, production, and distribution of engineering handbooks. ***Harry Baum.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 77-80.

13007* What Promotional Material Works Best for Industrial Distributors? A leading distributor tells how top industrial companies handle promotion for distributors. ***Murray E. Crain.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 82 + 3 pages.

13008* Employe Magazines Grow Brave, Grow Up. The "gossip column" house organs of yesteryear have been nudged out by a new breed of company magazines, equipped to attack any problem from inflation to Los Angeles smog. ***Robert Newcomb and Mary Sammons.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 119 + 2 pages.

13009* On Certain Formal Properties of Grammars. A grammar can be regarded as a device that enumerates the sentences of a language. We study a sequence of restrictions that limit grammars first to Turing machines, then to two types of system from which a phrase structure description of the generated language can be drawn, and finally to finite state Markov sources (finite automata). ***Noam Chomsky.*** *Information and Control*, v. 2, no. 2, June 1959, p. 137-167.

13010* Automatic Reading. A new information machine, developed under ARDC contract, translates typewritten pages into electrical signals at the rate of 200 characters per second. *Missile Design & Development*, v. 5, Aug. 1959, p. 8.

13011* Engineering Documentation. Design engineering groups hope to achieve designs worth producing. If they do, their output is the information needed to build, inspect, test, use and maintain the item. This paper work is far more important than many realize. The establishment of a set of uniform drafting standards for the Department of Defense has been a long sought goal. ***Phillip R. Wheeler.*** *Missile Design & Development*, v. 5, Aug. 1959, p. 28 + 2 pages.

13012* Soviet Developments in Machine Translation: Russian Sentence Analysis. The principles of Russian sentence analysis in MT are discussed. The description of various methods of receiving the grammar and vocabulary information for every word analyzed is given. The syntactic analysis of the Russian sentence is described. ***T. M. Nikolaeva.*** *MT, Mechanical Translation*, v. 5, no. 2, Nov. 1958, p. 51-59.

13013* The Use of Statistics in Language Research. The literature is reviewed; conclusion is that much of the work done is of little direct use for mechanical translation, and that some of it is based on a misapprehension of what statistical techniques can in fact do. ***A. F. Parker-Rhodes.*** *MT, Mechanical Translation*, v. 5, no. 2, Nov. 1958, p. 67-73.

13014* The Storage Problem. The bulkiness of linguistic reference data, contrasted with the limited capacity of existing random-access memory units, has aroused interest in means of conserving storage space. Various approaches to compression are described and evaluated. ***William S. Cooper.*** *MT, Mechanical Translation*, v. 5, no. 2, Nov. 1958, p. 74-83.

13015* Information Retrieval: Punched Card Techniques and Special Equipment. Look-up and compare method on a collator is outlined; description of superimposable numeric coding and scanning of coordinate descriptors, universal card scanner, and special index analyzer are described briefly. ***B. R. Faden.*** *Special Libraries*, v. 50, no. 6, July-Aug. 1959, p. 244-249.

INSTRUMENTATION

13016* X-Ray Camera for Study of Crystals at Low Temperatures. The design of a compact constant temperature chamber which can be used for X-ray studies of thermal properties of crystals at any steady temperature between −185 C and +200 C is described. ***M. A. Viswamitra.*** *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 6, June 1959, p. 326-332.

13017 Silicon Carbide Heating Elements and Their Application. III. Describes instruments for controlling heat input. Offers suggestions for prolonging service life of the elements. ***Edward Macer.*** *Industrial Heating*, v. 26, Aug. 1959, p. 1513 + 5 pages.

13018 An Improved Method of Preparing Materials for Measurement of Specific Surface by Air-Permeability. The results of the tests show that with mechanical preparation of the bed of powder for specific surface measurement in a Rigden-type air permeability apparatus, it is possible to obtain considerable improvement, first in the repeatability of the results obtained by an individual observer, and second, in the reproducibility of results obtained by two observers. ***T. H. Hughes.*** *Journal of Applied Chemistry*, v. 9, pt. 7, July 1959, p. 360-363.

13019 Determination of the Specific Surface Area of Powders by Air Permeability Method. ***Soji Tsumura.*** *Proceedings of the First Japan Congress on Testing Materials*, 1958, p. 167-173. (TA410 J27p)

13020* How Far Are We on Space Instrumentation? Instruments for collecting data on force fields, electromagnetic radiation, corpuscles and of picture recording of the earth and of celestial bodies are discussed. ***Ernst Stuhlinger.*** *Space/Aeronautics*, v. 32, no. 2, Aug. 1959, p. 147 + 4 pages.

13021 A Technique for Easy Removal of Direct Replicas for Electron Microscopy. ***W. H. Bridges and E. L. Long, Jr.*** Paper from "Symposium on Advances in Electron Metallography", p. 25-30, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13022 A Carbon Arc Image Furnace and Microscope for Studies at High Temperatures. The optical principles and operational and radiation characteristics of a 10-kw C arc image furnace employing paraboloidal mirrors 12 inches in diameter. Actual maximum irradiance in the image is 2.1 watts/mm²; a flux density equivalent to the radiation from a black-body at 2200 C. Stereomicrographs taken at room temperature show detail in the heated samples. ***H. W. Newkirk and B. B. Brenden.*** *U. S. Atomic Energy Commission, HW-59323,* May 20, 1959, 31 pp. (UF767 Un3.1hw Contin.)

See also: **12579** (radiometric instrumentation); **12580** (plant pH measurement); **12581** (magnetic flowmeter); **12582** (electronic propeller flowmeters); **12903** (ultrasonic flowmeter); **12904** (mass flowmeter); **13000** (small boiler instrumentation); **13058** (reed gage for shock studies).

LUBRICATION AND FRICTION

13023* Hydrodynamic Lubrication and Its Implication for Journal Bearing Design. ***F. T. Barwell.*** *American Society of Naval Engineers, Journal,* v. 71, no. 3, Aug. 1959, p. 505-510.

13024 The Structure and Lubricity of Adsorbed Fatty Films. A frictional study has been made on myristic acid and cetyl alcohol adsorbed on steel surfaces by retraction from their solutions and melts. The coefficient of friction was measured in reciprocating sliding at various temperatures up to 200 C. It was found that the retraction film from solution was of some mixed-film nature, even when the solvent was non-polar. In the reciprocating friction the lubricity of the film depends largely on its fluidity which relates closely to the ability of repairing the broken part of the film during sliding, and the film gave high friction in solid state and low friction on melting. The premelting of cetyl alcohol also decreased friction to some extent. ***Yasukatsu Tamai.*** *Journal of Physical Chemistry,* v. 63, Aug. 1959, p. 1283-1286.

13025* Lubricating Oil Additives: A Review. ***Mohan Lal Khanna and Joginder Singh Ahluwalia.*** *Journal of Scientific & Industrial Research,* v. 18A, June 1959, p. 260-267.

13026* Railroad Car Journal Plain Bearings. Design, construction, characteristics, testing, wicking, and lubricants. *Lubrication,* v. 45, Aug. 1959, p. 101-116.

13027* Theoretical and Practical Considerations as to the Lubrication of Ball Bearings. ***M. Baron.*** *Microtecnic* (English Edition), v. 13, no. 2, Apr. 1959, p. 83-87.

13028 Rate-Controlling Mechanism of Lubricating Oil Oxidation. Development of the "film" concept and its use for explaining oxidation of lubricating oil. ***Foo Heng Tse.*** *Ohio State University, Engineering Experiment Station Bulletin* 174, Mar. 1959, 41 pp. (TA21 O3b Vis.)

13029* Designing Oils for a 2-Stroke Engine. Fundamental requirements of a lubricating oil; lab test of oils. ***J. W. Savin.*** *SAE Journal,* v. 67, Aug. 1959, p. 62-63.

13030* A Theory of Lubrication in Journal Bearings With an Elastically Bent Shaft. The pressure distribution in a journal bearing with an elastically bent shaft is analyzed. In this case, there are two points where pressure is at a maximum. ***Y. Sugimoto.*** *Wear,* v. 2, no. 5, Aug. 1959, p. 329-334.

13031* Four-Ball Test on Lubricating Oils Containing Solid Particles. Effects of hardness, concentration of particles, and viscosity of oil. ***F. Hirano and S. Yamamoto.*** *Wear,* v. 2, no. 5, Aug. 1959, p. 349-363.

13032* Some Studies of Wear and Lubrication. Studies of wear and lubrication carried out at the Aldermaston laboratories of Associated Electrical Industries Limited are described. Optical, electron optical, radioactive tracer and metallographic techniques have been used to reveal the various stages of wear processes. Two distinct types of wear have been found: severe wear due to metallic welding, and mild wear in which the debris is more finely divided and mainly nonmetallic. In both types of wear transfer of material from one rubbing surface to the other can take place but, particularly with mild wear, the wear process is not unique but varies with the combination of materials and the rubbing conditions. ***A. W. Crook.*** *Wear,* v. 2, no. 5, Aug. 1959, p. 364-393.

MECHANICAL ENGINEERING

13033 Steady-State Behavior of the Dynamic Absorber. The resonant vibration of machinery and resiliently mounted equipment can be reduced with a dynamic absorber of suitable design. The necessary analytical and graphical information for an optimum design is presented. It is assumed that the absorber mass is attached resiliently to the vibrating item with a rubber-like material, and not with a spring and dashpot in parallel as considered in the classical theory of Ormondroyd and Den Hartog. The dynamic absorber utilizing a material with a stiffness proportional to frequency and a constant damping factor can reduce the resonant vibration of machinery and equipment items considerably. Its performance is superior to that of the classical dynamic absorber. ***J. C. Snowdon.*** *Acoustical Society of America, Journal,* v. 31, Aug. 1959, p. 1096-1103.

13034 Dynamic Force Measuring System for Machinery Vibration With Particular Application to Balancing of Assembled Machines. A system based on the use of four piezoelectric force transducers, which are installed between the feet of the machine under test and a terminating foundation, preferably a large seismic mass. ***T. W. Barraclough, R. D. Collier, and A. C. Summers.*** *Acoustical Society of America, Journal,* v. 31, Aug. 1959, p. 1104-1107.

13035 Structural Interplay: Design and Materials. Exploration of some of the less tangible aspects of the design-structures-materials complex to assess the significance of the demands of design. ***George Gerard.*** *Aero/Space Engineering,* v. 18, Aug. 1959, p. 37-42.

13036* Mechanics of Adhesive Joints. IV. Peeling Test. The equations relating the peeling load to the adhesive force were derived under the assumption that the peeling may proceed step by step from the attached end when the adhesive force is overcome by either the tensile stress along the interface (shearing peeling) or that which is perpendicular to the interface (tensile peeling). ***Yukihiko Inoue and Yonosuke Kobatake.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods,* v. 8, no. 5, 1959, p. 321-338.

13037* The Surface Area of a Screw. Formulas are derived for the surface area of a right cylindrical screw having as cross-section straight lines and/or circular segments. These formulas involve functions of incomplete elliptic integrals of the first, second, and third orders. ***John E. Maxfield and R. G. Selfridge.*** *Applied Scientific Research, Sec. A, Mechanics, Heat, Chemical Engineering, Mathematical Methods,* v. 8, no. 5, 1959, p. 377-385.

13038 Heat Transfer Between Concentric Rotating Cylinders. Experimental heat-transfer data are presented for four different values of clearance between the cylinders and for several combinations of outer to inner cylinder speed. The heat-transfer performance indicates three regimes of flow; first, at low peripheral velocities, in which laminar flow and heat transfer by conduction prevail, second, at cylinder speeds above a theoretically predictable value, in which vortex flow occurs and is the controlling mechanism, and third, at still higher speeds, in which a distorted type of vortex motion may be present. ***I. S. Bjorklund and W. M. Kays.*** *ASME, Transactions, Series C, Journal of Heat Transfer,* v. 81, no. 3, Aug. 1959, p. 175-186.

13039 Heat and Mass Transfer. Heat transfer by conduction, convection, and radiation; the transfer of mass; heat exchangers. ***E. R. G. Eckert and Robert M. Drake, Jr.*** 2nd Ed. 530 pp. 1959. McGraw-Hill, New York. (QC320 E57i2)

13040 Investigation of Prestressed Concrete for Highway Bridges. I. Strength in Shear of Beams Without Web Reinforcement. Tests of 43 rectangular and 56 I-beams are described and analyzed. The results of the investigation show that prestressed concrete beams without web reinforcement are vulnerable to shear failures. Unless web reinforcement is provided, the useful strength of such beams is limited to the inclined cracking load which may be only a small fraction of the flexural capacity. Observed differences in the response of a beam to applied load before and after initiation of an inclined crack lead to a new interpretation of the mechanism of shear failure. ***M. A. Sozen, E. M. Zwoyer, and C. P. Siess.*** *Illinois, University, Engineering Experiment Station Bulletin No.* 452, Apr. 1959, 69 pp. (T11I6b Vis.)

13041 Gear Couplings for Steel Mill Drives. The development of tooth forms that permit wide-angle engagement of mating gears with minimum backlash and acceptable gear contact has made practical the application of gear type couplings to spindle drives and other out-of-alignment shaft drives. This type gear also has been provided with special features, such as overload protection. ***P. Hollingsworth.*** *Iron and Steel Engineer,* v. 36, July 1959, p. 125-131.

13042* Digital Computer Analysis of Influence Coefficients for Deflection and Bending Moment of Orthotropic Parallelogram Plates. The skew network finite difference equation for the differential equation of equilibrium on the middle surface of the orthotropic parallelogram plate, expressed in Cartesian coordinates was proposed for the general case, $0 \leqq K = H/\sqrt{B_x B_y} \leqq 1$, and for the special boundary conditions where the plate is supported simply at the two opposite skew sides and supported by flexible girders at the other two sides. Influence coefficients of deflection and bending moment were calculated by the use of digital computers, UNIVAC-120 and Bendix G-15D, for the two cases of variables. ***Masao Naruoka and Hiroshi Omura.*** *Kyoto University, Memoirs of the Faculty of Engineering,* v. 21, pt. 2, Apr. 1959, p. 103-127.

13043 How to Specify Small Diameter Tubing. ***Harry W. Poole.*** *Machine Design,* v. 31, Aug. 20, 1959, p. 152-154.

13044 Motor Springs. A comparison of compact, high-deflection, spring-energy sources. ***F. A. Votta and C. R. Leidigh.*** *Machine Design,* v. 31, Aug. 20, 1959, p. 172-177.

13045 Round-Section Beams. Most design problems involve "long" beam members in which bending stresses are of primary concern. In "short" beams, however, such as stub axles and lugs, transverse shear stress may be the controlling consideration. Attention is focused on the application of bars and tubes of circular cross section as beam members. A general design procedure and basic concepts are presented along with simplified criteria for determining whether a beam is "long" or "short". ***Charles W. Bert.*** *Machine Design,* v. 31, Aug. 20, 1959, p. 179-181.

13046 Belt, Chain, and Gear Drives. Addition of a plastic inner ply in one type of flat belting resulted in marked improvements. The ribbed belt is the successful result of efforts to combine the strength and simplicity of the flat belt with the high grip and positive groove-tracking of the V-belt. Several types of chains and gears are discussed. Design procedures including ratio, speed, properties, and capabilities of belts, chains, and gears are considered. Other points of consideration include ratio accuracy, vibration and noise, efficiency, lubrication, and maintenance requirements. ***E. S. Cheaney, C. L. Paullus, and W. C. Raridan.*** *Machine Design,* v. 31, Aug. 20, 1959, p. 182 + 8 pages.

13047 Proceedings of the First Japan Congress on Testing Materials. 179 pp. 1958. The Japan Society for Testing Materials, Kyoto, Japan. (Ta410 J27p Over.)

13048 Proceedings of the Society for Experimental Stress Analysis. ***C. V. Mahlmann and W. M. Murray, editors.*** v. XVI, no. 2, 1959, 168 pp. Society for Experimental Stress Analysis, Cambridge, Mass. (TG265 So13p Vis.)

13049 A Three-Dimensional Photoelastic Investigation of the Stress Distribution in an Axially Thick Ring. Gives the stress distribution on critical planes in a ring containing a small hole and in which the axial thickness or length is 4.3 times the diameter of the hole. The principal stresses were determined by the shear-difference method for three-dimensional photoelasticity. ***M. M. Frocht and R. A. Thomson.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 1-10. (TG265 So13p Vis.)

13050 The Use of Digital Computers in the Photoelastic Solution of the General Space Problem by the Shear-Difference Method. Describes a method of using a computer to effect considerable saving of time and labor in obtaining the photoelastic solution to the problem of distribution of stress in the general three-dimensional case. ***R. A. Thomson.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 11-16. (TG265 So13p Vis.)

13051 Impact Loading of Structures Using Double Acting Bombs. A device was developed which gives a nearly rectangular force vs. time history, although it can be used to develop many different wave forms. The bomb is a piston with an explosive charge on each side of the piston. If the piston is not attached to the structure, the first charge applies the load, and firing the second charge removes the load from the structure. ***D. A. Stuart and A. L. Ruoff.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 17-26. (TG265 So13p Vis.)

13052 Development of a Triaxial Stress Testing Machine and Triaxial Stress Experiments. ***L. W. Hu.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 27-38. (TG265 So13p Vis.)

13053 The Failure of Tubes Under Combined External Pressure and Axial Load. The relationship between external pressure and axial load at failure was investigated for tubes which fail by plastic buckling under external pressure alone. Two series of experiments were conducted to determine the critical loading conditions. An attempt is made to correlate the results with the relevant formulas for elastic materials. ***W. Stuiver and P. F. Tomalin.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 39-48. (TG265 So13p Vis.)

13054 An Experimental Analysis of the Buckling of Thin Initially Imperfect Cylindrical Shells Subject to Torsion. ***W. A. Nash.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 55-68. (TG265 So13p Vis.)

13055 The Effect of Gage Current on Strain Measurements. The nominal strain, i.e., the strain calculated from the manufacturer's gage factor, depends on the gage current, or more specifically on the heat generated by the current. ***M. M. Frocht, D. Landsberg, and B. C. Wang.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 69-72. (TG265 So13p Vis.)

13056 Transducers for Strain Measurement in Intense Radiation Fields. A series of experiments is described in which high-temperature type strain gages were exposed to typical reactor radiations. The results indicate that foil transducers bonded to metal specimens with ceramic cements operate satisfactorily for limited integrated neutron fluxes. ***R. C. Smith and N. J. Rendler.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 73-80. (TG265 So13p Vis.)

13057 Modern Installation for Testing of Large Assemblies Under Static and Fatigue Loading. A modern installation has been made at Fritz Engineering Laboratory, Lehigh University, for testing large assemblies under static and fatigue loading. A description is given of (1) a test bed to which are attached (2) adjustable structural frames that enclose the full size structure and (3) the loading equipment obtained from the Amsler Testing Machine Company of Schaffhausen, Switzerland. Loads up to 110,000 lbs. per each of two hydraulic jacks and at rates of 250 or 500 cycles per

minute can be applied. ***B. Thürlimann and W. J. Eney.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 81-96. (TG265 So13p Vis.)

13058 Evaluation of a Reed Gage for Shock Studies. The design, calibration, and performance of a compact, rugged reed gage for use in the 100 to 2,000 cps frequency range is described. The results of a thorough evaluation show that the instrument can be expected to give results within an accuracy of 10% as long as the excitation is sufficient to produce readable reed displacements. ***R. W. Flygare and S. Rubin.*** Paper from "Proceedings of the Society for Experiemntal Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 97-104. (TG265 So13p Vis.)

13059 Comparison of Methods of Determining Stress Concentration Factor. Stress concentration factors determined analytically and photoelastically were compared with new measurements by wire-resistance strain gages for a V-notch Charpy impact specimen. The value obtained by strain measurement agrees with the analytical value and is about 12% lower than the value obtained photoelastically. Possible reasons for these differences are discussed. ***J. D. Lubahn.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 139-144. (TG265 So13p Vis.)

13060 An Optical Method for Studying Buckling of Plates. A method for visual and photographic observation is described. Models of stiffened plates (bulkheads) made of Perspex were loaded in shear and studied. The plates were illuminated by an extended, grid-shaped light source, the reflected image of which was photographed. The reflected image is very sensitive to changes in the curvatures of the reflecting surface, and when the plate is loaded beyond the critical limit the pattern of the resulting buckles is therefore clearly seen. ***I. Johnsen.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 145-152. (TG265 So13p Vis.)

13061 Short-Time Impulses Produced by Longitudinal Impact. Describes precise measurement of pulses in narrow rectangular bars generated by longitudinal impact of a ½ in. diameter steel ball. The pulses were detected by means of resistance wire strain gages of various lengths and sandwiched piezoelectric quartz crystals, and were compared to the measured change of momentum of both ball and bar. ***D. M. Cunningham and W. Goldsmith.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959, p. 153-162. (TG265 So13p Vis.)

13062 Dry-Friction Damped Isolators. Although they can outperform the better-known "viscous" type, they cause trouble at higher frequencies unless properly selected. Equations are derived for predicting vibration-transmissibility characteristics. ***G. W. Painter.*** *Product Engineering*, v. 30, no. 31, Aug. 3, 1959, p. 48-51.

13063 Saving Space With the Liquid Spring. Design and applications of liquid springs. ***Lloyd M. Polentz.*** *Product Engineering*, v. 30, no. 33, Aug. 17, 1959, p. 54-56.

13064 Glass-Fiber Sleeve-Springs for High Energy Absorption. Charts and equations giving stress, spring, and energy-absorption characteristics; sample design problem. ***Karl Maier.*** *Product Engineering*, v. 30, no. 33, Aug. 17, 1959, p. 60-63.

13065 Fluid-Flow Models Predict Design Performance. Flow of gases and liquid through passages and around obstructions is often difficult to predict on paper. Models are used to check design calculations, and to make sure that the fluids will behave as planned. ***A. A. Putnam and E. W. Ungar.*** *Product Engineering*, v. 30, no. 33, Aug. 17, 1959, p. 64-66.

13066 Latest Development in Spring-Wrapped Slip Clutches. Design and operation of two dual-spring clutches incorporated in a tape drive. ***J. Kaplan.*** *Product Engineering*, v. 30, no. 35, Aug. 31, 1959, p. 30-32.

13067* A New Method for Studying the Behaviour of Structures in the Elasto-Plastic Range. Chromoplasticity. New method of investigation, using models built of colored plastic material, affords possibility of following visually the zones of plastic deformation, their evolution, the formation of plastic hinges, the collapse mechanism, and the loading capacity of the system. ***Stefan Bălan, Sandu Răutu, and Valeriu Petcu.*** *Revue de Méchanique Appliquée*, v. 4, no. 1, 1959, p. 97-111.

13068* Vibration-Proofing for Missile Electromechanics. Vibration is difficult to simulate in tests. Describes how the vibration test problem was licked on the Snark missile program. ***R. S. Dillon.*** *Space/Aeronautics*, v. 32, no. 2, Aug. 1959, p. 46-49.

13069* Breakthrough Needed for Extreme Environment Fluid Sealing. Sealing problems on operation from −400 to +1000 F are discussed. A break-through may come from polymer technology or from heat-resistant "elastomeric-inorganic" composites. ***A. A. LaPera.*** *Space/Aeronautics*, v. 32, no. 2, Aug. 1959, p. 50-53.

13070* Strain Gages for Higher Temperature Measurements. The need for high speed, high temperature testing has forced strain gage designers to push on to new limits of miniaturization and reliability. Reviews latest developments and new applications. ***Paul Beckman and Herbert Yanowitz.*** *Space/Aeronautics*, v. 32, no. 2, Aug. 1959, p. 65 + 4 pages.

13071 Theoretical Elasticity. Discusses modern methods in the theory of elasticity in a form that does not require extensive mathematical experience. Treats variational methods, thermoelasticity, wave motion, and non-linear elasticity. ***Carl E. Pearson.*** 218 pp. 1959. Harvard University Press, Cambridge, Mass. (QA931 P31t)

13072 The Effect of Configurational Additions Using Viscoelastic Interfaces on the Damping of a Cantilever Beam. A quasi-static analysis of a cantilever beam damped by an added configuration involving viscoelastic interfaces is presented. Optimum values of viscoelastic damping are calculated and compared with calculated values of damping due to hysteresis of the structural material of a plain beam. Experimental data show fair agreement with the theory both as to order of magnitude and trends toward optimum values. ***James S. Whittier.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-568, May 1959, 59 pp. (TL507 Un3.18w Vis.)

See also: **12988** (gas turbine progress report); **13230** (effects of changes in steel beam sections).

METALLURGY

13073* Evaluation of Properties Obtained From an Air-Induction and Vacuum-Arc Melted High-Temperature Alloy. Studies on W-545 alloy. ***J. Bulina and J. T. Brown.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 571-577.

13074 Unprotected Magnesium Performs Well in Automotive Parts. Performance and characteristics of engine and body components. ***H. A. Schertel.*** *Automotive Industries*, v. 121, no. 4, Aug. 15, 1959, p. 60 + 2 pages.

13075 Properties of Vacuum-Treated Steels. Studies of steels treated by the vacuum-lifter process and Al killed, to obtain information on the distribution of nonmetallic inclusions and Al within the same heat and among a great many heats. Transverse and longitudinal mechanical properties. Influence of grain size on properties of Si-killed vacuum steels. Behavior of steel in cold upsetting, pressing, deep drawing, and machining. ***C. H. Pottgiesser, A. Wicher, and E. Klein.*** *Henry Brutcher Translation No.* 4604, 10 pp. (From *Stahl und Eisen*, v. 79, no. 8, 1959, p. 468-472.) Henry Brutcher, Altadena, Calif.

13076 Waste Heat Recovery at the LD Steelworks in Donawitz (Austria). Progress made with waste heat recovery at Donawitz works (in conjunction with electrostatic dust precipitation). Principle of Lamont boiler used to bring temperature of outgoing gases from 1800 C (3270 F) to about

300 C (570 F). Heat recovery by steam production. ***A. Vacek.*** *Henry Brutcher Translation No.* 4644, 12 pp. (From *Berg- und Hüttenmännische Monatshefte*, v. 104, no. 2, 1959, p. 21-26.) Henry Brutcher, Altadena, Calif.

13077* Uses and Abuses of Aluminum in Wooden-Hulled, Aluminum-Frame Minesweepers. Service failures are illustrated. Most of them were caused by use of incorrect materials, substitution of materials not given in specifications, poor industrial manufacturing or insufficient technical control. Zn chromate as a corrosion inhibitor for Al alloys gave satisfactory service. ***T. H. Rogers and W. K. Chinn.*** *Corrosion*, v. 15, Aug. 1959, p. 21-26.

13078 High-Temperature Metals—Their Role in the Technological Future. Probable nature of future requirements; materials available or likely to be developed; future demands for high-temperature metals; supply outlook. ***Clyde Williams.*** 16 pp. 1958. American Society for Testing Materials, Philadelphia, Pa. (TN607 G41)

13079* The World's Hottest Alloys. I. A comprehensive report on progress and possibilities in the development of high temperature alloys including cost and obtainability of important metals. ***Harry B. Goodwin.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 20 + 5 pages.

13080* The Availability, Recovery and Properties of Rhenium Metal. Rhenium, a relatively new and unknown metal, is inherently rare and probably will continue to be expensive. However, at least a few thousand pounds can be readily obtained yearly as a by-product from Mo concentrates. Its extremely high melting point and good metal properties indicate a growing use for those applications where a relatively high cost can be tolerated. ***Ivor E. Campbell, D. M. Rosenbaum, and B. W. Gonser.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 185-191.

13081 Vacuum Melted Metals and Alloys—Why Use Them? Process, applications and costs. ***John L. Everhart.*** *Materials in Design Engineering*, v. 50, Aug. 1959, p. 89-97.

13082 Materials for Springs. Survey of the 35 most popular metal spring materials, including tabular comparisons; important design properties of C steels, alloy steels, stainless steels, Ni alloys, Cu alloys, and a Co alloy. ***John T. Milek.*** *Materials in Design Engineering*, v. 50, Aug. 1959, p. 115-126.

13083* Molybdenum—Vanguard Material for Space Vehicles. Mechanical and physical properties of Mo, brittle-ductile transition temperature, laminations, 45° preferred-angle cracking, recrystallization, fabricability, sectioning, forming, joining, mechanical fasteners, machinery, and coatings for oxidation resistance. ***Alan V. Levy and Saul E. Bramer.*** *SAE Journal*, v. 67, Aug. 1959, p. 41-46.

13084 Steel in the Soviet Union. Report on tour of Soviet steel plants by representatives of the U. S. steel industry. 39 pp. 1958. American Iron and Steel Institute, New York. (TS 304.R9 Am35sq Over.)

13085 A Symposium on Aluminium in Packaging, London, June, 1958. Characteristics of Al; use in cans, collapsible tubes, foil, and closures. 185 pp. 1958. Aluminium Development Assn., London. (TN775 AL81.7s)

13086* Air-Hardening Graphitic Steel. Simpler processing makes it an exceptionally desirable material for tool and die applications. ***C. F. Jatczak, O. A. Pfouts, and D. J. Girardi.*** *Tool Engineer*, v. 43, no. 2, Aug. 1959, p. 63-68.

13087 High-Strength Zirconium Alloys. Investigation of properties of Zr alloyed with Al, Sn, and Mo for nuclear reactor application. ***R. K. Wagner and H. E. Kline.*** *U. S. Atomic Energy Commission, NAA-Sr-3481*, July 15, 1959, 34 pp. (UF767 Un3.1na Contin.)

13088 Exploratory Investigation of Advanced-Temperature Nickel-Base Alloys. An entire series of alloys that do not require vacuum melting techniques and that generally provide good stress-rupture and impact properties was evolved. ***John C. Freche and William J. Waters.*** *U. S. National Aeronautics and Space Administration, NASA Memorandum* 4-13-59E, May 1959, 39 pp. (TL782 Un3rm Vis.)

13089* Compositions in the Systems Niobium-Boron and Tantalum-Boron. In both systems the following compounds exist: M_2B_2, MB, M_3B_4, and MB_2 (M stands for Nb or Ta respectively). The existence of Ta_2B was confirmed. None of these alloys are resistant to scaling. (*In German.*) Beitrag zum Aufbau der Systeme Niob-Bor und Tantal-Bor. ***Hans Nowotny, Friedrich Benesovsky, and Richard Kieffer.*** *Zeitschrift für Metallkunde*, v. 50, July 1959, p. 417-423.

See also: **12434** (magnesium structures in space vehicles).

METALS—CORROSION

13090* The Corrosion of Road Vehicle Engines by Anti-Freeze Solutions. Causes of corrosivity. Inhibitors triethanolamine phosphate-Na mercaptobenzothiazole, Na benzoate-Na nitrite, and borax, sometimes with the addition of soluble oil, are discussed and the qualitative importance of the aeration of the anti-freeze solution and the presence of Cu in the waterway is indicated. ***H. H. Collins and R. I. Higgins.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 12, June 1959, p. 667-691 + 4 plates.

13091 Some Factors Affecting the Performance of Condenser and Heat Exchanger Tubes. ***P. T. Gilbert.*** *Chemistry & Industry*, 1959, no. 28, July 11, p. 888-895.

13092* Corrosion of Aluminum Alloy in Glycol-Water Cooling Systems. Galvanic corrosion in an aircraft oil cooler. Corrosion mechanism on Al alloy 52S; results are given of tests designed to find satisfactory inhibitors. ***N. S. Dempster.*** *Corrosion*, v. 15, Aug. 1959, p. 13-16.

13093* Notch Sensitivity Effects in Stress Corrosion and Hydrogen Embrittlement Tests on High Strength Steels. The various high-strength steels differ from each other in their resistance to brittle fracture under stress in the presence of a notch. It is shown that this purely mechanical phenomenon may terminate a stress-corrosion test in such fashion as to give an erroneous impression of the rate of stress-corrosion cracking. ***B. F. Brown.*** *Corrosion*, v. 15, Aug. 1959, p. 17-20.

13094* Zinc in Marine Environments. Data from unpublished experiments and the literature are reviewed and analyzed on behavior of Zn in marine atmospheres and in sea water immersion. ***E. A. Anderson.*** *Corrosion*, v. 15, Aug. 1959, p. 27-30.

13095* Corrosion Problems Associated With Sour Gas Condensate Production. Reservoir studies indicate a need for cycling of the sour gases for greater ultimate recovery of liquid hydrocarbons. Experience to date has indicated that corrosion can be controlled and these toxic gases safely produced and processed. ***D. R. Fincher.*** *Corrosion*, v. 15, Aug. 1959, p. 31-34.

13096* The Internal Cathodic Protection of Large Steel Pipes Carrying Sea Water. At the moment the most economical method of protection seems to involve the use of a cheap readily-applied coating of reasonable resistance and cathodic protection from point anodes mounted at or close to the center line of the pipe. ***John H. Morgan.*** *Corrosion*, v. 15, Aug. 1959, p. 35-40.

13097* Duct Anode Development and Experience in Protection of Underground Cables From Corrosion. Discusses tests conducted on high Si Fe anodes in ducts containing silt. Graphite anodes in silt-filled ducts have short life because gases, liberated by electrolysis and trapped by silt, attack the graphite binder, tape adhesive and wire insulations. ***J. E. Johnson.*** *Corrosion*, v. 15, Aug. 1959, p. 41-45.

13098* Probability as Related to Stress Corrosion Cracking of Copper Alloys. Factors determining the probability of stress corrosion cracking of Cu alloys are concentration of ammonia present, concentration of water, concentration of air, stress level, and susceptibility of particular alloy to stress corrosion cracking. ***D. H. Thompson.*** *Corrosion*, v. 15, Aug. 1959, p. 51-54.

13099* Stress Corrosion Cracking of Oil Country Tubular Goods. Stress corrosion cracking as encountered in oil production is discussed as two problems: sulfide corrosion cracking and sweet corrosion cracking. A new test method is given which uses a notched ring loaded to different percentages of yield deformation. ***R. L. McGlasson and W. D. Greathouse.*** *Corrosion*, v. 15, Aug. 1959, p. 55-60.

13100* Corrosion of Type 310 Stainless Steel by Synthetic Fuel Oil Ash. In an investigation of the corrosion of Type 310 stainless steel in synthetic fuel oil ash, the minimum temperatures at which the steel was attacked by a mixture of V_2O_5 and Na_2SO_4 and by mixtures of V_2O_5 and $NaVO_3$ were determined. An unidentified phase was produced at the interface between the steel and a V compound or mixtures of compounds in the temperature range 1075 to 1890 F. ***Hugh L. Logan.*** *Corrosion*, v. 15, Aug. 1959, p. 61-64.

13101 Kinetics of the Dissolution of Copper in Oxygen-Containing Solutions of Various Chelating Agents. ***J. Halpern, H. Milants, and D. R. Wiles.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 647-650.

13102 The Oxygen-Evolution Reaction at Gold Anodes. I. Accuracy of Overpotential Measurements. The various sources of error in overpotential measurements are evaluated, a new cell design for uniform current distribution described, and the c.d. limits determined for measuring η to $\pm$ 1 mv. ***Sidney Barnartt.*** *Electrochemical Society, Journal*, v. 106, Aug. 1959, p. 722-729.

13103* Kinetics of the Oxidation of Uranium by Carbon Dioxide. ***J. E. Antill and K. A. Peakall.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 227-231.

13104* Corrosion of Aluminium Alloys in High Temperature Water—A Survey. Study of grain boundary, accelerated, and uniform attack, and their prevention. ***Ketil Videm.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 145-153.

13105* The Corrosion of Austenitic Stainless Steels Under Heat Transfer in High Temperature Water. Corrosion of two 18/8 austenitic stainless steels under stress and boiling heat transfer in O-free water at *p*H 11 and 280 C. ***J. N. Wanklyn and D. Jones.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 154-173.

13106 High Temperature Corrosion of Metals. I. How Corrosion Products Form. II. Alloy Composition Determines Corrosion Products. III. Gas Composition and Flow Determine Corrosion Products. IV. Some Surface Treatments Can Increase Corrosion Rates. V. Thermal Cycling and Temperature Affect Protective Films. ***C. J. Guare.*** *Materials in Design Engineering*, v. 50, Aug. 1959, p. 110-114.

13107 Corrosion Principles Applied to Piping and Hot Water Systems. ***L. J. Huetter and H. H. Stadelmaier.*** *North Carolina State College, Department of Engineering Research, Bulletin No.* 72, May 1959, 43 pp. (TA21 N81b Vis.)

13108 Corrosion Studies for the HRT Chemical Processing Plant. Tantalum was the only satisfactory corrosion-resistant material for use in a dissolver tank or tank liner for handling 10.8 *M* H_2SO_4 solution. Ruthenium was found to be an accelerant of corrosion attack on Carpenter 20-Cb stainless steel and Hastelloy B in boiling and He-aerated 4 *M* H_2SO_4 solution. ***J. L. English, J. C. Griess, and D. J. Krause.*** *U. S. Atomic Energy Commission, ORNL*-2735, July 24, 1959, 41 pp. (UF767 U30 Contin.)

See also: **12583** (rust protection of steel structures); **12715** (anticorrosive pigment); **13373** (oxidation of U, Zr, Pu, and Th); **13586** (corrosion in water-cooled air-conditioning systems).

METALS—EXTRACTION AND REFINING

13109* The Present State of Titanium Extractive Metallurgy. Chloride chemistry has been advanced through the knowledge acquired in the production and purification of anhydrous Ti and ZrCl. A very bright horizon has opened to the contemporary electro-metallurgist for the winning and purification of at least a dozen elements, with a solid cathode deposit. ***W. J. Kroll.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 546-553.

13110* The Action of Molten Uranium on Graphite. It has been shown that when molten U contacts graphite, a continuous carbide layer clads the graphite. This layer probably protects the graphite against more rapid corrosion, but is itself not stable toward molten U. ***E. L. Swarts.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 553-554.

13111* Removal of Fission Products From Molten Thorium-Uranium Alloy. Thorium-uranium (10 wt. %) alloy samples were partially decontaminated using a salt-bed process. The method consists of induction melting the alloy supported by a vertical column of compacted Ca fluoride. ***A. G. Buyers, J. Chilton, and W. E. McKee.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 624-626.

13112* The Efficiency of Zone-Refining Processes. It is shown that the optimum conditions for solvent purification and solute concentration are identical. If the solute is initially distributed uniformly, a determination of the optimum ratio of zone length to length of the ingot yields the values unity and < 0.3 for most efficient passage of the first two zones. ***L. W. Davies.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 672-675.

13113* Further Information on Sampling Liquid Steel for Dissolved Oxygen. Samples taken in quick succession with four modifications of the bomb sampler showed good agreement. Type C: Al cup in cavity, steel cap over mouth; and D: fine Al wire in cavity, steel cap over mouth are recommended. ***F. C. Langenberg and J. M. Snook.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 706-707.

13114 Ways of Avoiding the Formation of Flakes in Steel. Effect of kind of melting unit used; drying the charging materials; refractories and ingot mold coatings; degassing of solid steel by various practices. ***W. Küntscher and K. Werner.*** *Henry Brutcher Translation No.* 4236, 13 pp. (From *Neue Hütte*, v. 2, no. 5, 1957, p. 280-285.) Henry Brutcher, Altadena, Calif.

13115 Some Theoretical Questions About Vacuum Metallurgy. Outline of some questions associated with the behavior of substances in a vacuum and the resultant technological features of vacuum melting. Pressure to be maintained in relation to vapor pressure of metal or alloy being melted in a vacuum furnace. Degree of vacuum ensuring the expected amount of degassing, as a function of the vapor pressure of metal being melted. Viewpoints governing the selection of the materials for crucibles, thermocouple sleeves, stoppers, etc., in vacuum metallurgy. ***D. S. Kamenetskaya.*** *Henry Brutcher Translation No.* 4364, 13 pp. (From a Collection of Papers (A. M. Samarin, edit.) *'Primenenie Vakuuma v Metallurgii'* (Use of Vacuum in Metallurgy). Published by the USSR Academy of Sciences, Moscow, 1958, p. 49-53.) Henry Brutcher, Altadena, Calif.

13116 On the Technology of Vacuum Melting of Metals and Alloys. Review of Russian vacuum melting equipment: its drawbacks and how they were eliminated. Data on a 110-lb. furnace for melting steel in high vacuum; design of vacuum system. Operation of furnace: rapid evacuation: maintenance of vacuum during heats. Development of a method for making high-grade melting crucibles directly in furnace. Performance of various refractories such as rammed magnesite, pre-fired alumina, pre-fired beryllia, technical zirconia, and zirconia remelted in an arc furnace. ***A. V. Emiashev.*** *Henry Brutcher Translation No.* 4365, 12 pp. (From a Collection of Papers (A. M. Samarin, edit.) *'Primenenie Vakuuma v Metallurgii'* (Use of Vacuum in Metallurgy). Published by the USSR Academy of Sciences, Moscow, 1958, p. 54-61.) Henry Brutcher, Altadena, Calif.

13117 Production of Compact Carbon-Free Ferrochromium and Metallic Manganese by Vacuum Treatment. Original setup for commercial-scale vacuum treatment of ferroalloys at a Russian plant. Subsequent improvements made to the original setup after operating experience (eight months). Composition of dusts deposited on walls of vacuum tank. Best vacuum in tank for compact buttons. Dependence of gas content of ferro-Cr on grain size. ***S. I. Khitrik, N. Ia. Neimark, V. I. Nikolaev, and M. I. Gasik.*** *Henry Brutcher Translation No.* 4373, 17 pp. (From a Collection of Papers (A. M. Samarin, editor) *'Primenenie Vakuuma v Metallurgii'* (Use of Vacuum in Metallurgy), Published by USSR Academy of Sciences, Moscow, 1958, p. 112-122.) Henry Brutcher, Altadena, Calif.

13118 Vacuum Degassing of Low-Carbon Unkilled Steel During Pouring or During Solidification in the Mold. I. Boiling of Unkilled Low-Carbon Steel Under Vacuum. II. Stream Degassing of Unkilled Low-Carbon Steel. I. ***G. Henke and W. Hess.*** II. ***H. Hoff, H. J. Kopineck, and G. Opfer.*** *Henry Brutcher Translation Nos.* 4599-4600, 7 and 7 pp. (From *Stahl und Eisen*, v. 79, no. 7, 1959, p. 405-410.) Henry Brutcher, Altadena, Calif.

13119 Operating Experience in the Vacuum Treatment of Open-Hearth Steels. Use of vacuum-lifter installation. Progress of vacuum treatment with time. Difficulties encountered with refractory lining of vacuum vessel, especially the suction nozzle, and how they were overcome. Bottom life of degassing tank. Capacity of degassing tank was increased from 6 to 12 m. tons for improved degassing efficiency. Operating results. ***C. H. Pottgiesser, H. J. Daermann, and A. Drevermann.*** *Henry Brutcher Translation No.* 4603, 13 pp. (From *Stahl und Eisen*, v. 79, no. 8, 1959, p. 463-468.) Henry Brutcher, Altadena, Calif.

13120 Commercial Vacuum Treatment of Steel for Rolling and Forging Ingots and Castings. A General Discussion. First experimental setup for vacuum-lift degassing in Dortmund. Relative merits of vacuum-lifter (Dortmund-Hörde) and recirculation (Ruhrstahl) processes. Arrangement for injection of additional gas in vacuum-lifter process. Experimental work done at Huckingen on degassing of 40-ton heats in the ladle. ***K. Brotzmann, et al.*** *Henry Brutcher Translation No.* 4606, 20 pp. (From *Stahl und Eisen*, v. 79, no. 9, 1959, p. 634-638.) Henry Brutcher, Altadena, Calif.

13121 Improvement of Ingot Structure by Vibration of Solidifying Steel. Experimental confirmation of theoretical predictions on effect of vibration of steel ingots on their structure. Nature of action of motion on solidification. ***A. A. Romanov and P. V. Umrikhin.*** *Henry Brutcher Translation No.* 4610, 14 pp. (From *Izvestiya Vysshikh Uchebnykh Zavedenii, Chern. Metall.*, 1958, no. 7, July, p. 37-43.) Henry Brutcher, Altadena, Calif.

13122 Experimental Operation of a New Blast-Furnace Top Distributor. Description of a new BF top distributor having an intermediate hopper and giving an improved stock distribution, satisfactory gas flow, and good furnace working in the hearth zone (normally operating at high-speed top). ***N. S. Shchirenko, I. G. Polovchenko, V. P. Dobrov, and A. M. Labkovskii.*** *Henry Brutcher Translation No.* 4613, 10 pp. (From *Stal'*, v. 18, no. 12, 1958, p. 1066-1071.) Henry Brutcher, Altadena, Calif.

13123 Waste Heat Boiler Systems and Gas Cleaning Plants Downstream of LD Vessels and Converters. Installation of waste-heat boiler plants downstream of LD O process vessels and bottom-blown converters for complete elimination of brown fumes by wet mechanical methods either alone or combined with wet electro-filters, with scarcely any increase in investment cost of the steelworks. ***H. Rasworschegg.*** *Henry Brutcher Translation No.* 4645, 13 pp. (From *Berg- und Hüttenmannische. Monatshefte*, v. 104, 1959, p. 31-40.) Henry Brutcher, Altadena, Calif.

13124* Gaspe Copper Smelter Operations. Design and operation of the smelter and some of the changes which have recently been made. ***R. L. Johnston.*** *Canadian Mining and Metallurgical Bulletin*, v. 52, no. 567, July 1959, p. 446-453.

13125 Continuous Casting. Development of a horizontal process for cast Fe and non-ferrous bar. ***Z. Stokowiec.*** *Iron & Steel*, v. 32, no. 7, June 1959, p. 323 + 4 pages.

13126 Oxygen Desiliconizing Provides Hot-Metal Electric Steelmaking. New pre-refining process with O which meets all the objections of the duplex process, and in addition, produces a metal with sufficient C to make final decarburization in the arc furnace (using the O lance) simple and rapid. ***H. W. A. Waring and Emrys Davies.*** *Journal of Metals*, v. 11, Aug. 1959, p. 515-517.

13127 Oxygen Open-Hearth Practice in the USSR. *Journal of Metals*, v. 11, Aug. 1959, p. 520-522.

13128* A Contribution to the Problem of the Mechanism of Reactions Involved in Reduction of Iron Oxides. A study of the part played by low Fe oxides as catalysts of the semiconductor type and of the process of atomization of the elementary Fe particles on their surfaces. During reduction the chemical and phase transformations can take place in various amounts and are linked together by the reaction diffusion of Fe. Activation absorption of the reduced gases on the surface of the oxide is the initial act of the reduction reaction. (*In Russian.*) K voprosu o mekhanizme reaktsii vosstanovleniia okislov zheleza. ***S. T. Rostovtsev, L. N. Rudenko, and V. K. Simonov.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 2, p. 5-8.

13129* Assimilation of Lime and Slag-Forming Mixtures by Basic Chrome-Containing Slag. Effect of ferrous oxide on diffusion of lime in the slag during the entire melting period of the open hearth melt. In the middle and at the end of the melting period an increase of Al_2O_3 in the slag up to 9 to 12% improves the assimilation of lime by the slag. Beyond this percentage, the assimilation decreases. (*In Russian.*) Assimiliatsiia izvesti i shlakoobrazuiushchikh smesei osnovnym khromsoderzhashchim shlakom. ***A. L. Klein, P. V. Umrikhin, and V. A. Startsev.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 2, p. 27-31.

13130 99.99999999% Pure. Zone melting of transistor materials with radio-frequency heating produce ultra-high purity, low-cost transistors. ***Eric Leslie.*** *Radio-Electronics*, v. 30, Sept. 1959, p. 38-39.

13131* The Low-Shaft Blast Furnace of Ougrée as a Small Experimental Furnace. Results of the operation in 1958. (*In German.*) Der Niederschachtofen in Ougrée als kleiner Versuchshochofen. ***Von Edouard Bonnaure.*** *Stahl und Eisen*, v. 79, no. 16, Aug. 6, 1959, p. 1105-1119.

13132* Nitrogen as an Alloying Element in Manganese-Vanadium Structural Steels From the Open-Hearth Furnace. Kinds of linkage of the N and solubility of the nitrides in steels containing Al and V as dependent on temperature and heat-treatment. (*In German.*) Stickstoff als Legierungselement in Mangan-Vanadin-Baustählen aus dem Siemens-Martin-Ofen. ***Hans-Joachim Wiester, Hanns Arnt Vogels, and Horst Ulmer.*** *Stahl und Eisen*, v. 79, no. 16, Aug. 6, 1959, p. 1120-1129.

13133 Bubbling Helium Helps Degas Steel. Hydrogen can now be removed by a new ladle degassing process for less than 1 cent a pound. *Steel*, v. 145, Aug. 17, 1959, p. 106 + 1 page.

13134 Recovery of Enriched Uranium Scrap. Recovery as carried out at Y-12; criticality aspects of recovery; low assay enriched U recovery; radioactive waste handling. U. S. *Atomic Energy Commission, NYO*-2700, July 1959, 113 pp. (UF767 U3ny Contin.)

13135* H-Iron. H-iron may be produced with a wide degree of reduction-percentage removal of O from ore charged. In an open hearth, a lower degree of reduction is preferred; a 95% removal of O is best for an electric furnace. ***Nat Wood.*** *Western Metalworking*, v. 17, July 1959, p. 37-39.

See also: **13156** (vacuum melting of steel); **13249** (zone refinement of Sn); **13272** (activity of C in liquid Fe alloys); **13279** (vacuum treatment of steel); **13286** (ingot solidification); **13557** (steel plant dust removal).

METALS—FINISHING, POLISHING, AND CLEANING

13136 "Microstoning" Generates Precise Finishes. This final finishing process, using up to 1200-grit abrasive stones, generates a controlled micro-inch finish on practically any material, and at the same time corrects geometrical errors caused during previous machining operations. ***Rupert Le Grand.*** *American Machinist*, v. 103, July 27, 1959, p. 96-98.

13137* The Nature of Industrially Polished Metal Surfaces. Industrial polishing occurs basically by cutting and not by surface flow. Deformed layers are produced on the surface. Quantitative data on the depth of the layer are given for brass specimens finished by a representative range of industrial methods. A number of associated surface effects are considered together with their likely effects on electrodeposits subsequently applied to the surface. Of particular interest is the observation that the obliteration of surface cavities, which is frequently noted after industrial polishing, appears to be due to the collapse of the cavities by compression and not to the smearing of a film across the surface. ***L. E. Samuels.*** *Australian Institute of Metals, Journal*, v. 4, no. 1, May 1959, p. 1-11.

13138 Barrel Finishing of Castings. Barrel finishing reduces costs by cutting man-hour requirements. It can be used to remove surface imperfections, deburr, polish, radius, burnish, and grind. ***L. D. Stevens.*** *Foundry*, v. 87, Aug. 1959, p. 65-67.

13139* Thirty Years of Metal Degreasing. Historical review of equipment and procedures in Great Britain. *Machinery Lloyd (Overseas Ed.)*, v. 31, no. 15, July 18, 1959, p. 80-82.

METALS—FOUNDRY PRACTICE

13140* The B.C.I.R.A. Experimental Cupola Installation. The plant has been designed with the emphasis on flexibility so that it can be used to investigate the widest possible range of cupola problems. It can be readily adapted for cold- or hot-blast melting and is very fully instrumented. ***H. J. Leyshon and R. I. Higgins.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 12, June 1959, p. 658-666 + 7 plates.

13141* Some Methods of Reducing the Degree of Nucleation of a Grey Cast Iron in Relation to Sinking Under Bosses on Thin Plates. ***A. G. Fuller.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 12, June 1959, p. 725-733.

13142* Work Study in the Foundry. Time and productivity studies. ***W. B. Trenholme.*** *British Foundryman*, v. 52, July 1959, p. 314-322.

13143 Centrifugal Castings of Double-Flange Cast-Iron Pipe. Report on a new process of making sand molds for, and centrifugal casting of, water pipe and condenser tubes (10 ft. long and 4 in. I. D.), for which a number of design and technical advantages are claimed. Technology of screw-ram molding-data on machine used and its operation; spinning speeds; hourly output. Centrifugal casting machine; design and operating details; slope; hourly output. Molding sand mixture, effect of its moisture content on surface condition of mold; best additives for prevention of metal penetration into mold; data on permeability, composition, and green strength of molding mix. ***M. M. Levin and V. M. Krapukhin.*** *Henry Brutcher Translation No.* 4272, 13 pp. (From Liteinoe Proizvodstvo, 1957, no. 6, June, p. 1-4.) Henry Brutcher, Altadena, Calif.

13144* Some Quality Grey Irons of the French Navy. Better mechanical characteristics of grey iron are obtained by decreasing the amount of graphite, by transforming the matrix by adding special elements, or by thermal treatment. Resistance to corrosion is improved by additions of Ni, Cu, Mn or Cr up to 1%, and especially by austenitic structure. (*In French.*) Quelques fontes grises de qualité dans la marine. ***Roger Poirot.*** *Fonderie*, no. 161, June 1959, p. 251-261.

13145* Treating Ingot Mold Cast Iron by Means of Sodium Carbonate. Results of Tests. Granulated sodium carbonate, 2 to 5 mm. in grain size, was introduced in a proportion of 1%, in some cases of 1.5%. Effect on C was studied before and after desulfurization. The S content was lowered. The average life of ingot molds was improved by 23.6, 14.57, and 11.25%. (*In Russian.*) Traitement de la fonte pour lingotières par le carbonate de soude. Résultats d'essais. ***André Gibeau.*** *Fonderie*, no. 161, June 1959, p. 262-265.

13146 Rotor Bodies for Motors Cast Centrifugally. Casting Al bars, end rings, and fan blades in steel electric motor rotors. The most critical factor in casting is temperature of the rotor bodies, top and bottom molds, and the molten metal. ***W. S. Atkinson.*** *Foundry*, v. 87, Aug. 1959, p. 54-56.

13147 Design Can Influence Foundry Cooling. High heat loads ordinarily rule out conventional cooling methods in a foundry. Temperature control is primarily a question of ventilation—putting air in motion either naturally or artificially. ***H. E. Knowles.*** *Foundry*, v. 87, Aug. 1959, p. 57-59.

13148 Permanent Mold Castings. Preliminary investigations indicate that a further evaluation should be made of the potential use of Al-rich Zn-base alloys as low-cost permanent mold casting materials. ***E. Belkin.*** *Foundry*, v. 87, Aug. 1959, p. 70-74.

13149 The Hot Forming Property of Moulding Sand. Formula for the deformation at elevated temperatures. Degree of hot deformation at breaking load. Influence of moisture content, of admixtures and bentonite additions. (*In German.*) Die Warmverformung von Formsand. ***Harry W. Dietert and Tom E. Barlow.*** *Giesserei*, v. 46, no. 15, July 16, 1959, p. 421-424.

13150* The Closure of Crucible Induction Melting Furnaces. Advantages and disadvantages of several types of closures and effect of closure on life of crucible lining. (*In German.*) Der Ofenverschluss bei Tiegel-Induktionsschmelzöfen. ***Hermann Zepernick.*** *Giesserei*, v. 46, no. 16, July 30, 1959, p. 451-453.

13151 Packaged Foundries. Survey of the Hallsworth automatic molding system. ***H. B. Hallsworth, R. D. Mills, and Peter Spear.*** *Iron & Steel*, v. 32, no. 7, June 1959, p. 335-337.

13152* What Makes Cast Iron "High-Quality"? Quality of materials, chemical composition, and cupola temperature all play a vital part in high-grade irons. Inoculations with "graphitizers" which prevent primary carbides forming, and judicious alloying, can materially improve the mechanical properties. ***John Obrebski.*** *Metalworking Production*, v. 103, no. 32, Aug. 7, 1959, p. 1203-1206.

13153* Solidification Times of Simple Shaped Castings in Sand Molds. I. Literature Review and Preliminary Work. II. Size and Shape Effect on Solidification Time. III. Mold Material Effects. ***J. Berry, V. Kondic, and G. Martin.*** *Modern Castings*, v. 36, Aug. 1959, p. 39-66.

13154* The Control of Quality in the Brass Foundry. Importance and methods of quality control. ***Harry M. St. John.*** *Modern Castings*, v. 36, Aug. 1959, p. 67-75 .

13155* Aluminum Alloys Fluidity Test. Fluidity Tripled With New Mold Coating. Development of an accurate and reproducible sand mold fluidity test; measurement of the relative fluidities of several typical Al alloys using the test method developed; study of mold coatings effects on fluidity in sand molds, especially hexachloroethane. ***M. C. Flemings, H. F. Conrad, and H. F. Taylor.*** *Modern Castings*, v. 36, Aug. 1959, p. 86-97.

13156* Behavior of Gases During Vacuum Arc Melting of Steel. Under proper conditions vacuum arc melting can decrease the gas content to less than half of that in the metal before remelting. In the interval studied, the speed of melting has a real effect on the degassing process: when this speed increases, H degasification decreases whereas O and N degasification increases. (*In Russian.*) Povedenie gazov pri vakuumnoĭ dugovoĭ plavke stali. ***L. N. Belianchikov, R. N. Grigorash, and A. V. Panov.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 2, p. 48-55.

13157 Aluminum Castings—Permanent Molds Can Handle Short Runs Too. Cast Fe molds can economically handle a great variety of work. Gives the why and how of designing for 1200 castings or less. ***W. A. Hamilton.*** *Product Engineering*, v. 30, no. 35, Aug. 31, 1959, p. 40-41.

13158* Ceramic Mold Technique Produces Accurate, High Quality Castings. ***Howard Simmons.*** *Western Metalworking*, v. 17, Aug. 1959, p. 39-42.

METALS—HEAT TREATMENT

13159 Thermomagnetic Treatment of Magnetically Soft Alloys With a Rectangular Hysteresis Loop in Vacuum Furnaces. Heat treatment of ferromagnetic Fe-Ni and Fe-Ni-Co alloys, consisting in heating in vacuum and cooling in a magnetic field. Adaption of vertical vacuum furnace with Nichrome, etc., heating coils to thermomagnetic treatment. Layout of magnetizing device and arrangement of specimens. Study of effect of conditions of thermomagnetic treatment on properties of alloys under investigation, 0.002-0.004 in. gage. ***O. N. Al'tgauzen, Sh. I. Zusman, and A. N. Stepanova.*** *Henry Brutcher Translation No.* 4435, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 11, Nov., p. 60-62.) Henry Brutcher, Altadena, Calif.

13160 Heat Treating the Stainless Steels. III. Annealing ferritic types. ***S. W. Cole.*** *Industrial Heating*, v. 26, Aug. 1959, p. 1524-1526.

13161 Convection and Radiation in High Speed Heating. Includes graphic data. ***Norman H. Davies and Richard J. Reed.*** *Industrial Heating*, v. 26, Aug. 1959, p. 1546 + 9 pages.

13162 Titanium Alloy Sheet Treated to Record Strength by New Method. Report tensile strengths of 190,000 lb. per sq. inch. *Industrial Heating*, v. 26, Aug. 1959, p. 1572 + 1 page.

13163* The Why and How of Quenching. Description and discussion of the quenching process. ***Clarence A. Siebert.*** *Metal Treating*, v. 10, no. 4, July-Aug. 1959, p. 4 + 4 pages.

13164* Continuous Stress-Relief of Transformer Laminations. Discussion of lift-off and continuous furnace methods. ***Anthony Nicholls.*** *Metal Treating*, v. 10, no. 4, July-Aug. 1959, p. 8 + 1 page.

13165* Developments in Heat Treatment. I. Progress of Closed-Quench Furnaces. Survey of multi-purpose, closed-quench furnaces for bright hardening, carbonitriding and gas carburizing. ***J. McMullen.*** *Metalworking Production*, v. 103, no. 31, July 31, 1959, p. 1179-1182.

13166* High Frequency Resistance Annealing of Wire. High frequency resistance heats metals faster and with greater consistency than any other known method and can be adapted to anneal wire on a continuous basis. ***David G. Osterer.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 963 + 2 pages.

13167* Heat Treatment of Rod and Wire. Discussion of heat treating cycles, patenting, annealing, and stress relieving. ***R. T. Merrell, E. F. Frederick, and G. R. Decker.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 972 + 2 pages.

See also: **13180** (induction hardening of steel); **13195** (heat treatment of Si).

METALS—MECHANICAL AND PHYSICAL PROPERTIES

13168* The Embrittlement of Glass-Coated Silver Wire on Heat Treatment. The embrittlement of the glass-coated wires is indirectly caused by the migration of some component, typical of the glass, to the grain boundaries of the Ag. It seems apparent that the glass must fuse for this process to take place. ***Chikara Hirayama.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 622-624.

13169* The Effect of Oxygen on the Tensile Properties of Titanium. The proportional limit and the rate of work hardening are a function of O content. The previously reported yield strength increase due to O appears to be primarily the result of the increase in rate of work hardening. ***C. Feng, C. Elbaum, and W. C. Winegard.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 632-635.

13170* The Effects of Melting and Casting Procedures on the Elevated Temperature Properties of Nickel and Cobalt-Base Alloys. ***M. J. Stutzman and J. W. Cunningham.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 637-646.

13171* The Aging of Hydrogen-Charged Rimmed Steel. The yield point of rimmed steel sheet was eliminated by electrolytic charging with H. The activation energy for its return on aging was found to be identical to that measured for the return of the yield point on aging after plastic deformation of the same steel, uncharged. It is proposed that H eliminates the yield point by causing localized plastic deformation during charging. ***H. C. Rogers.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 666-672.

13172* Temperature Dependence of the Critical Stress for Slip in Magnesium Alloy Monocrystals. Reports on the variation with temperature of critical stress for basal slip of binary solid-solution single crystals of In and of Th in Mg. Data show solid-solution hardening by In only at 78°K. A considerable strengthening effect of Th was observed at all temperatures. ***W. F. Sheely, E. D. Levine, and R. R. Nash.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 693-694.

13173* Note on the Change in Stored Energy Produced by Reversed Deformation. Small compressions soften, rather than harden, prestretched Cu and, as predicted by Polakowski, at the same time decrease the amount of stored energy. The maximum decrease occurs between 5 and 10% compression; compressions greater than about 15% begin to add stored energy again. ***A. S. Lyer and Paul Gordon.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 729-730.

13174 The Mechanical Properties of Irradiated Niobium. Effect of heavy neutron irradiation (10^{20} n cm^{-2}) at 16 C. ***M. J. Makin and F. J. Minter.*** *Acta Metallurgica*, v. 7, June 1959, p. 361-366.

13175 Creep Processes in Polycrystalline Aluminium. Study as to whether plastic deformation is due to one or both of two processes, namely, grain deformation and grain sliding. ***W. A. Rachinger.*** *Acta Metallurgica*, v. 7, June 1959, p. 374-375.

13176 The Hardening and Embrittlement of Mild Steel by Cyclic Stressing at the Fatigue Limit. Dependence of yield stress at 20 C and fracture stress at −196 C upon grain size. ***J. Holden.*** *Acta Metallurgica*, v. 7, June 1959, p. 380-388.

13177* The Effect of Phosphorus on the Mechanical Properties of Flake Graphite Cast Iron. ***G. N. J. Gilbert.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 12, June 1959, p. 692-724 + 6 plates.

13178 Ductile-Brittle Transition in the Refractory Metals. Investigations on Cb, Mo, W, Cr, V, and Ta. ***F. R. Schwartzberg, H. R. Ogden, and R. I. Jaffee.*** *Battelle Memorial Institute Defense Metals Information Center, DMIC Report No.* 114, June 25, 1959, 71 pp. (TN799.T5 B32.7t Vis.)

13179 Failure of High-Temperature [Ni-Base] Alloys Under Thermal and Stress Cycling. Study of effect of simultaneous thermal cycling and periodic stressing (50 min. under load and ten min. unloaded) on strength and creep of various Ni-base alloys. Damage curves for static and periodic stressing; principal factors promoting the development of cracks at high temperatures. ***G. V. Kurganov and Iu. A. Sutina.*** *Henry*

Brutcher Translation No. 4391, 9 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 10, Oct., p. 23-27.) Henry Brutcher, Altadena, Calif.

13180 Contact Fatigue of Medium Carbon Steel Induction Hardened Instead of Carburized. Study of possible merits of induction hardening over carburizing for steel gears to serve under high contact pressures. Set-up and procedure for measuring contact fatigue. Effect of case depth, core hardness, and preceding heat treatment (quenching + tempering, or normalizing) on contact fatigue strength. ***T. N. Nazarova.*** *Henry Brutcher Translation No.* 4434, 6 pp. (From *Metallovedenie i Obrabotka Metallov*, no. 11, Nov. 1958, p. 57-59.) Henry Brutcher, Altadena, Calif.

13181 Study of Boron-Alloyed High Chromium-Nickel Cast Iron of the Sormait Type. Study of effect of B additions ranging from 0.2 to 0.5% upon the wear resistance of a hard-facing composition containing 2.75-3.50% C, 3-4 Si, 0.5-1.25 Mn, 24-30 Cr, 5-6 Ni, and max. of 0.05 P or S. ***G. S. Kachalkin.*** *Henry Brutcher Translation No.* 4452, 5 pp. (From *Metallovedenie i Obrabotka Metallov*, Dec. 1958, no. 12, p. 58-61.) Henry Brutcher, Altadena, Calif.

13182 Elevated-Temperature Properties of Chromium Steels (12-27 per cent). Presents summary curves for tensile strength; 0.2% offset yield strength; per cent elongation and reduction of area; stresses to produce rupture in 100, 1000, 10,000, and 100,000 hours; and stresses for creep rates of 0.0001 and 0.00001% per hr. (1.0% in 10,000 and 100,000 hrs.). Data for 23 steels ranging from 12 to 27% Cr are given. ***Ward F. Simmons and Howard C. Cross.*** 113 pp. 1958. American Society for Testing Materials, Philadelphia. (TA479.C5 Si47rc)

13183 The Tensile Properties of High-Purity Niobium at Low Temperatures. Tests over the range 196 to 240 C yield points were observed at all temperatures, the magnitude of the yield drop increasing with decreasing temperature. The temperature dependence of the yield stress was similar to that of other body-centered cubic metals, and the material was ductile at 196 C. ***B. F. Dyson, R. B. Jones, and W. J. McG. Tegart.*** *Institute of Metals, Journal*, v. 87, pt. 10, June 1959, p. 340-342.

13184* Atom Movements and Dislocation Structures for Plastic Slip in Single Crystals of β-Uranium. ***M. L. Kronberg.*** *Journal of Nuclear Materials*, v. 1, no. 1, Apr. 1959, p. 85-95.

13185* The Effects of Heating Neutron Irradiated Beryllium. If Be is used in a reactor at temperatures less than about 500 C, the He produced by the fast neutron reactions will remain in solution. There will be a considerable embrittling effect due to the normal displacement damage and to the He in solution. At temperatures above 500 C the He will precipitate to form bubbles which will cause the Be to increase its volume. It is possible that the embrittling effects overlap so that irradiated Be never regains the ductility it orginally had. ***J. B. Rich, G. B. Redding, and R. S. Barnes.*** *Journal of Nuclear Materials*, v. 1, no. 1, Apr. 1959, p. 96-105.

13186* Contribution to the Development of Heat-Resistant Titanium Alloys. Aging tests were performed in order to examine the embrittlement of alloys containing more than 7% Al. The behavior of the $TiAl_3V_2$ alloy during production and working is described as well as that during creep resistance and cyclic bending tests at room and elevated temperature. (*In German.*) Beitrag zur Entwicklung warmfester Titanlegierungen. ***Ulrich Zwicker.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 165-184.

13187* Properties of Titanium-Aluminium-Niobium Alloys. The addition of Nb to a binary Ti-Al alloy results in increased strength at temperatures up to 500 C. ***J. Suiter.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 232-236.

13188* Grain Flow In Steel. General discussion, including importance of flow lines; macro-etching. ***J. Lomas.*** *Machinery Lloyd (Overseas Ed.)*, v. 31, no. 16, Aug. 1, 1959, p. 69-71.

13189 Metal Fatigue. Fundamentals; fatigue properties of engineering materials and components; fatigue testing of engineering components. ***J. A. Pope, editor.*** 381 pp. 1959. Chapman & Hall Ltd., London. (TA460 P81f)

13190* Experimental Investigation of the Specific Heat of Metals. Thermal characteristics of titaniums VT-1D and VT-2D, Duralium D-16 and steel EI-654. Thermal capacity was studied up to 500-600 C. The indirect heating method and the displacement method were used in studying hard bodies. Linear dependence of the specific heat. (*In Russian.*) Eksperimental'noe issledovanie teploemkosti metallov. ***T. N. Andrianova.*** *Nauchnye Doklady Vysshei Shkoly, Energetika*, 1959, no. 1, p. 149-157.

13191* Properties of Cold-Hardened Chrome Nickel Austenitic Steels of the 18-8 Type at Low Temperatures. The high plasticity of this steel depends upon the presence of a cubic face-centered lattice making slip possible at a low temperature along a complementary system of planes (111), and upon martensite transformation which increases the possibility of uniform deformation of the metal. Pieces can be made by forming under pressure at low temperatures; yield is increased by a preliminary cold hardening at room temperature. (*In Russian.*) Mekhanicheskie svoĭstva nagartovannykh khromonikelevykh austenitnykh staleĭ tipa 18-8 pri nizkikh temperaturakh. ***N. N. Liulecheva and N. V. Pisareva.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 2, p. 217-220.

13192 Optical Properties of Tellurium and Selenium. ***Robert S. Caldwell and H. Y. Fan.*** *Physical Review*, v. 114, 2nd ser., no. 3, May 1, 1959, p. 664-675.

13193 Hall Effect, Resistivity, and Magnetoresistivity of Th, U, Zr, Ti, and Nb. Measurements at temperatures between 1 K and room temperature and in magnetic fields up to 30 kilogauss. Strong temperature and purity dependences are observed in the Hall coefficients of U, Ti, and Zr. In addition, the Hall coefficient of Zr was strongly dependent upon magnetic field strength at liquid He temperatures. Comparisons with theory have been carried out, and it is concluded that existing theories are not sufficiently general to account quantitatively for the observed temperature and magnetic field dependences of the Hall effect and resistivity. Unusual behavior was observed in the magnetic-field-induced superconducting transition of Nb. ***Ted G. Berlincourt.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 969-977.

13194* An Experimental Investigation on the Mode of Slip in Face-Centered Cubic Metals. The changes of saturation of magnetization of the ordered Ni_3Mn and Pt_3Co alloys caused by plastic deformation were used as the criterion to decide whether the slip in metals takes place in atomic steps on many successive atomic planes or in large steps on widely separated single atomic planes. ***Tadami Taoka, Kō Yasukōchi, Ryukichi Honda, and Isao Oyama.*** *Physical Soicety of Japan, Journal*, v. 14, July 1959, p. 888-894.

13195* Effects of Heat Treatment Upon the Electrical Properties of Silicon. Experimental studies of processes in which changes of carrier concentration and minority carrier lifetime are introduced into Si by heat treatment at 400-1200 C. ***Yasuo Matukura.*** *Physical Society of Japan, Journal*, v. 14, July 1959, p. 918-923.

13196 Fatigue Strength of Notched and Cracked Mild Steel Plate Specimens Under Pulsating Tension. Fatigue limit for crack initiation of notched C steel specimens under reversed stresses can be reasonably explained on the basis of the fatigue limit of plain specimens by considering the thickness of a surface layer, concerned in the origin of fatigue cracks, of about 0.05 ~ 0.06 mm. for C steels annealed or normalized, irrespective of the sharpness of notches or the C content of steels. ***Tsunemi Uryu.*** *Proceedings of the First Japan Congress on Testing Materials*, 1958, p. 1-3. (TA410 J27p)

13197 Fatigue Strength of Steel Specimens With Double Notches. Fatigue strength of materials with double notches is essentially less than that which would be expected from a consideration of each notch separately. ***Minoru Kawamoto and Morio Seki.*** *Proceedings of the First Japan Congress on Testing Materials*, 1958, p. 3-6. (TA410 J27p)

13198 Fatigue Study of Carbon Steel by Etching. Attempts to determine how and when a fatigue crack starts in a specimen of C steel subjected to cyclic stresses. ***Takeshi Inukai.*** *Proceedings of the First Japan Congress on Testing Materials*, 1958, p. 23-25. (TA410 J27p)

13199 Investigations on the Relation Between the Internal Friction and the Scattering of Fatigue Strength of Steel With Internal Flaws. ***Hideo Miki.*** *Proceedings of the First Japan Congress on Testing Materials,* 1958, p. 26-29. (TA410 J27p)

13200 Detection of Fatigue by Ultrasonic Attenuation. Measurements of ultrasonic attenuation were made and correlated with fatigue damage. ***Ichiro Konishi, et al.*** *Proceedings of the First Japan Congress on Testing Materials,* 1958, p. 41-44. (TA410 J27p)

13201 Creep of Low Carbon Steel Varying Temperatures. Experiments on 0.14% C steel, conducted under varying temperatures where variation of temperature is in a particular range from 425 to 500 C. Creep deformation is predicted approximately from results of constant temperature tests by using the assumption that deformation is uniquely determined by the current values of strain, strain rate, temperature and stress at that instant, independent of their past values. ***Toshio Nishihara, Shuji Taira, Kichinosuke Tanaka, and Masateru Ohnami.*** *Proceedings of the First Japan Congress on Testing Materials,* 1958, p. 48-51. (TA410 J27p)

13202 A Tester for Creep Rupture Under Multiaxial Stress. Describes apparatus in which tubes may be tested by combinations of tension, compression, torsion, and internal pressure at temperatures up to 500 F. ***I. Finnie.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959. p. 49-54. (TG265 So13p Vis.)

13203 An Apparatus for Conducting Tensile Tests at Moderately Elevated and Sub-Zero Temperatures. ***F. J. Anders, M. W. Toaz, and E. J. Ripling.*** Paper from "Proceedings of the Society for Experimental Stress Analysis", v. XVI, no. 2, Cambridge, Mass. 1959. p. 127-138. (TG265 So13p Vis.)

13204 Properties of Cast Iron at Elevated Temperatures. ***J. R. Kattus and Bryan McPherson.*** 90 pp. 1959. American Society for Testing Materials, Philadelphia. (TA475 K15r)

13205 Symposium on Brittle Failure of Rotor Forgings. Inspection of large rotor forgings; rotor forgings for power equipment manufacturers; work of task group on brittle failure; requirements for turbine and generator rotor forgings; influence of geometric factors on results of ultrasonic testing of heavy forgings; axial test bore in turbo-generator rotors. ***George E. Danner, et al.*** 43 pp. 1958. American Society for Testing Materials, Philadelphia. (TJ873 Am35sb)

13206 Effect of Changing Cyclic Modulus on Bending Fatigue Strength. Influence of the observed increasing cyclic modulus in super-purity Al on stress distribution in bending-fatigue specimens. Resulting stress redistribution is examined for the various types of fatigue tests in common use. Observations of the development of slip bands and fatigue cracks. ***A. A. Blatherwick and B. J. Lazan.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 56-127 (Pt. II), May 1959, 27 pp. (TL507 Un3.18w Vis.)

13207 Development of High Strengths and High Recrystallization Temperatures in Molybdenum-Base Alloys. Preparation and study of Mo-base alloys representing optimum compositions from the standpoint of compatibility with existing process equipment; studies on practicability of preparing large castings of these alloys in the consumable electrode equipment; variables associated with the extrusion of large bodies of Mo. ***M. Semchyshen, Gordon D. McArdle and Robert Q. Barr.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-551, Feb. 1959, 116 pp. (TL507 Un3.18w Vis.)

13208 Fatigue Studies of INOR-8. Studies of a Ni-Mo-Cr alloy for high-temperature service. The temperature and frequency dependence of fatigue properties of INOR-8 were determined by rotating-beam fatigue tests. Stress-lifetime data were obtained for temperatures of 1100, 1300, and 1500 F, and cyclic frequencies of 100, 600, and 3000 cpm. ***Raymond G. Carlson.*** *U. S. Atomic Energy Commission, BMI-*1354, June 26, 1959, 16 pp. (UF767 U3b Contin.)

13209 Fatigue Studies of Inconel. Axial-load fully alternating fatigue tests were performed in the range 1300 to 1500 F, for frequencies of 6 and 60 cpm. Continuous traces of load and strain were made to determine relationships between stress, strain, and lifetime, for lifetimes within the range of 10^3 and 10^6 cycles. ***Raymond G. Carlson.*** *U. S. Atomic Energy Commission, BMI-*1355, June 26, 1959, 19 pp. (UF767 U3b Contin.)

13210 Interim Report on Creep Characteristics of Zircaloy-2. ***P. J. Pankaskie.*** *U. S. Atomic Energy Commission, HW-*59383 (Rev.), Mar. 25, 1959, 15 pp. (UF767 Un3.1hw Contin.)

13211 Charpy-V Transition Temperatures of Ferritic Iron Alloys. I. Iron-Oxygen and Iron-Aluminum. ***J. E. Srawley.*** *U. S. Office of Naval Research. NRL Report* 5290, Apr. 6, 1959, 17 pp. (T21 Un3.5n Contin.)

See also: **13162** (strength of Ti sheet); **13259** (strength of Ti alloys); **13273** (H embrittlement of Fe-C alloys); **13281** (hardness of cast iron); **13294** (deformation of steel).

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13212 Heat and Speed From Latest Titanium Alloys. One-pass forming with no spring-back and no restrike is practical for new Ti aircraft and missile alloys if the forming is done hot. ***George H. DeGroat.*** *American Machinist,* v. 103, July 27, 1959, p. 108-111.

13213* Surface-Finish Measurement on Nonferrous Materials. Present-day commercial instruments and surface-finish standards are evaluated. Qualitative and quantitative measurements; multiple-parameter measurements; surface-finish specifications. ***Bradley Piper and William P. Callis.*** *American Machinist,* v. 103, Aug. 10, 1959, p. 105-120.

13214 Factors Influencing the Performance of Grinding Wheels. A study of the nature of grinding-wheel wear indicates that the grinding-wheel wear curve is similar to those of other cutting tools. It demonstrates further that the type of grinding operation significantly affects the nature of wheel wear. A unique technique was developed for very accurately measuring grinding-wheel wear. This measured wear may be translated into terms of "grinding ratio", which is the generally accepted parameter for measuring wheel wear. It is the ratio of the volume of metal removed per unit volume of wheel worn away. ***E. J. Krabacher.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 3, Aug. 1959, p. 187-200.

13215 The Effect of Process Variables on Extrusion Pressures of Lead. Billets of commercially pure Pb, 2 in. diam. x 3 in. long were extruded at room temperature through five different die contours at ram speeds up to 50 ipm. It was found that, for the direct and indirect extrusions, with good lubrication (white Pb in oil) and with good cylinder-wall finish, the extrusion pressure-displacement diagrams were essentially the same. The concentric and eccentric single-bar and multibar extrusions at constant extrusion ratio required approximately the same pressures when extruded at identical speeds. ***J. Frisch and E. G. Thomsen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 3, Aug. 1959, p. 207-216.

13216 Approximate Solutions to a Problem of Press Forging. The velocity vectors in the flash and body of a press forging of commercially pure lead having axial symmetry were obtained experimentally from incremental displacements in stepwise forging operations. It was found that the velocities are in excellent agreement with those derived with the aid of a simple disk theory, where it was assumed that all deformation is concentrated in a fictitious disk. Comparison with velocities derived from certain slip-line solutions also shows that substantial agreement exists between theory and experiment. ***S. Kobayashi and E. G. Thomsen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry,* v. 81, no. 3, Aug. 1959, p. 217-227.

13217 Theory and Experiment of Press Forging Axisymmetric Parts of Aluminum and Lead. The mechanics of finishing in a press-forging operation were analyzed. It was concluded that the metal in the die, as well as that contained in the flash, could be treated as a fictitious disk which is subjected to

compression between flat surfaces under variable surface friction. Comparison of experimental average pressures with those predicted by the foregoing simplified theory showed good agreement. ***S. Kobayashi, R. Herzog, J. T. Lapsley, Jr., and E. G. Thomsen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 3, Aug. 1959, p. 228-238.

13218 A Three-Dimensional, Tool-Life Equation—Machining Economics. Two tool-life equations are derived, one limited equation and one general tool-life equation, between the variables cutting speed, chip equivalent, and tool life. The chip equivalent, introduced by Woxén, is a well-defined function of feed, depth of cut, nose radius, and side-cutting-edge angle. The limited equation takes into account the variation of Taylor's exponent n with the value of the chip equivalent, but the equation is only valid within certain limits of cutting speed and chip equivalent. An expression called the productivity is derived. This relationship is valid for either maximum production or minimum cost and, combined with the general, hyperbolic, tool-life equation, it is used to investigate the optimum combination of tool-life, cutting speed, and chip equivalent. ***Bertil N. Colding.*** *ASME Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 3, Aug. 1959, p. 239-250.

13219 Some Observations on the Shearing Process in Metal Cutting. It was found that shearing forces on the shear plane are linear functions of the area on which they act. This was observed for all materials investigated, for SAE 1112 steel, 2024-*T4*, and 6061-*T6* Al alloys, and alpha-brass, and also is in agreement with data taken from the literature. The shearing stresses for the other materials tested or examined were also constant for the limited range of variables available. In contrast to the shearing stress, the normal stress on the shear plane was not constant and appears to be a yet unknown function of the mechanism of friction on the tool face. ***S. Kobayashi and E. G. Thomsen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 2, Aug. 1959, p. 251-262.

13220 Observations on the Angle Relationships in Metal Cutting. Orthogonal-cutting experiments using SAE 1112 free-cutting steel, 2024-T4 and 6061-T6 Al alloys, and alpha-brass (85 Cu-15 Zn) at feeds of 0.002 to 0.010 ipr, were performed on a lathe with 18-4-1 high-speed-steel cutting tools. The mean cutting speeds and rake angles for SAE 1112 varied from 33.7 to 170.8 fpm and 5 to 40 deg, respectively, while the remainder of the alloys were tested at conditions yielding a continuous chip without a built-up edge at speeds ranging from approximately 470 to 790 fpm. It was found that the angle between the shear plane and the resultant tool force was only approximately constant for each test condition and varied with cutting speed. ***D. M. Eggleston, R. Herzog, and E. G. Thomsen.*** *ASME, Transactions, Series B, Journal of Engineering for Industry*, v. 81, no. 3, Aug. 1959, p. 263-279.

13221 "Building-Block" Standards for High Production Machine Tools. *Automotive Industries*, v. 121, no. 4, Aug. 15, 1959, p. 58 + 4 pages.

13222 Machining Cylinder Blocks on Advanced Transfer Machines. I. Description of machines used to produce cylinder blocks for three basic engines in setup which handles units of different bank heights on same equipment. ***Joseph Geschelin.*** *Automotive Industries*, v. 121, no. 4, Aug. 15, 1959, p. 70 + 4 pages.

13223 Special Features of Stelco's New Soaking Pits. Description of 12 new soaking pits to serve a new 46-in. blooming mill. ***E. T. W. Bailey.*** *Iron and Steel Engineer*, v. 36, July 1959, p. 72-79.

13224 Application of Stretch Reducing of Tubes for Greater Production and Economy. Typical application of stretch reducing; relation between wall reduction and diameter reduction; methods of cutting tubes coming from mills; types of mills and drives; advantages in stretch reducing of tubes. ***William Rodder.*** *Iron and Steel Engineer*, v. 36, July 1959, p. 100-106.

13225 Process Programming of Automatically Controlled Rolling Mills. I. The Part Played by the Electrical Manufacturer. II. The Role of the Steel Mill Engineer. Automatic card programming of rolling mills reduces operating personnel requirements, provides rolling operation flexibility, insures process duplication and adherence to predetermined optimum operating conditions, increases production through continuity of operation, and offers a process control which can be integrated into a plant production accounting system. I. ***E. H. Browning.*** II. ***H. G. Frostick.*** *Iron and Steel Engineer*, v. 36, July 1959, p. 107-117.

13226* Metal Working Lubricants. Review of lubricants for rolling, forging, drawing, cutting, and grinding. *Lubrication*, v. 45, July 1959, p. 85-100.

13227* Contribution to the Present State of Knowledge in Cold and Hot Shaping Processes. Multiple step subdivision of a shaping process; survey of processing operations; measuring accuracy; surface roughness. ***Otto Kienzle.*** *Microtecnic* (English Edition), v. 13, no. 2, Apr. 1959, p. 51-65.

13228* Some Experience in Tube Extrusion. It is concluded that tube extrusion forces are a function of the same variables as those found in rod extrusion; that tube eccentricity is caused primarily by the geometry, alignment and rigidity of the piercing tools; and that the piercing plug weight can be greatly reduced. ***G. Sachs and A. Draper.*** *Microtecnic* (English Edition), v. 13, no. 2, Apr. 1959, p. 66-76.

13229* Application of Reversal Methods to Concentricity Tests. The advantages of the described method are: (1) arbors and reference gages are tested as used; (2) the reference gage and the component to be tested may be tested; (3) such tests, owing to the reversal method, may be carried out with tools of moderate accuracy. ***Jacques Simonet.*** *Microtecnic* (English Edition), v. 13, no. 2, Apr. 1959, p. 77-82.

13230* Possibilities of Saving Steel by Use of Sections. Quantitative effects by modification of I and U sections and effects of these modifications on production costs and rolling mill capacity are discussed. (*In German.*) Untersuchung von Möglichkeiten zur Stahleinsparung bei Verwendung von Formstahl. ***K. Rytel.*** *Neue Hütte*, v. 4, June 1959, p. 343-351.

13231 Aluminum Forgings for Precision Tolerances. ***D. D. Erhard and S. J. Krajewski.*** *Product Engineering*, v. 30, no. 33, Aug. 17, 1959, p. 51-53.

13232* A Comparative Investigation of Tooling Conditions by Cutting on the Turning Lathe With Cutters Equipped With Ceramic and Hard Alloy Tips. The optimum values of the geometric parameters of ceramic and hard alloy tips are approximately equal. Compared with hard alloy tips, the application range of ceramic tips is more narrow. The quality of the treated surface is better on cutting with ceramic tips. (*In Russian.*) Sravnitel'noe issledovanie uslovīī obrabotki rezaniem na tokarnom stanke reztsami, osnashchennymi mineralo-keramicheskimi plastinkami i plastinkami iz tverdvkh splavov. ***M. Popov, I. Mitrica, and E. Dechu.*** *Revue de Mécanique Appliqueé*, v. 4, no. 1, 1959, p. 173-194.

13233 What's Going On in Electromachining. Progress report on spark machining, in which a shower of electrical sparks is used to blast off metal particles, and electrolytic machining, in which the metal is electrolytically deplated from the work. *Steel*, v. 145, Aug. 24, 1959, p. 80-83.

13234 Titanium Machining Techniques. *Titanium Metals Corporation of America, Titanium Engineering, Bulletin No. 7*, 31 pp. (TN799.T5 T53t Contin.)

13235* Standard or Special Drills . . . Proper Application Reduces Costs. ***Carl J. Oxford, Jr.*** *Tool Engineer*, v. 43, no. 2, Aug. 1959, p. 50-54.

13236* Cutting Hard Materials With Ceramics. Ceramic tools are being successfully used to rough, semifinish, and finish turn high-strength alloy steels. ***D. T. Bisceglia and J. W. Rodd.*** *Tool Engineer*, v. 43, no. 2, Aug. 1959, p. 79-82.

13237* Determining Effectiveness of Drawing Lubricants. Illustrates how statistics can be used in tooling experiments by application to determine procedure and evaluate results of an actual experiment. ***Donald F. Eary.*** *Tool Engineer*, v. 43, no. 2, Aug. 1959, p. 83-90.

13238* Advanced Lubricants and Pressure Dies for Better Wire Drawing. ***Earl A. Bowers, Jr.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 953 + 4 pages.

13239* The Production of Stainless Steel Wire. The operation of a fully integrated stainless steel wire mill today is a complex process because stainless steel wire must now conform to a large series of standards which formerly were not of particular importance. ***Gilbert C. Klingel.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 954 + 4 pages.

13240* The Production of High Carbon Steel Wire. Production of rope wire, furniture spring wire, tire bead wire, and prestressed concrete wire. ***Stewart S. Gray.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 958 + 3 pages.

13241* Borax in the Wire Drawing Industry. Borax coatings for drawing steel rod have inherent advantages in neutralizing residual acid, corrosion protection, as a lubricant carrier, and freedom from dust. ***Grover G. Collins.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 968 + 2 pages.

See also: **13041** (rolling mill gear couplings); **13167** (heat treatment of rod and wire); **13521** (machining Teflon).

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

13242 Equilibrium Shape of an Edge-Dislocation Loop in the Presence of a Supersaturation of Vacancies. Investigation takes into account the fact that dislocations climb out of the slip plane with the aid of jogs. With reasonable energies of formation and interaction of these jogs, the shape of the loops depends strongly on the crystalline structure at normal temperatures. At very high temperatures the shape of the loop approaches that of a circle. In all cases, the average radius of curvature is of the same order of magnitude as that found by Bardeen and Herring. (*In French.*) Forme d'equilibre d'un arc de dislocation coin en presence d'une sursaturation de lacunes. ***G. Saada.*** *Acta Metallurgica*, v. 7, June 1959, p. 367-373.

13243 Theory of Order in Ternary Alloys. II. A statistical theory of order-disorder transformations for ternary alloys of abitrary composition and crystal structure is given. Long-range and short-rango order parameters are defined, and equations connecting these parameters are given. The general formula for configurational free energy is deduced and the method of calculation of the order-disorder transition temperature is shown. ***K. F. Wojciechowski.*** *Acta Metallurgica*, v. 7, June 1959, p. 376-379.

13244* Decoration and Etching of Silver-Doped Rocksalt Crystals by Surface Gas Reactions. Silver-doped rocksalt crystals were treated with different hydrocarbons and with a mixture of CH_4 and O_2 at higher temperatures. Besides decoration of dislocations and in some cases cavity formation, spiral etch-pits were formed after a treatment with CH_4 and O_2. The decoration is due to electrons from H or free radicals. The spiral etch-pits are presumably formed by an inhomogeneous concentration of reaction products in the gaseous vapor phase around an active site. ***W. Bontinck and W. Ekeyser.*** *Acta Metallurgica*, v. 7, June 1959, p. 389-391.

13245 Appearance of Dislocations in Metal Crystals on Evaporation: Twinning Dislocations and Their Relation to Annealing Twins in Copper. Evaporation of Cu surfaces produces a step-structure which is related to the orientation of the crystals. On non-coherent twin boundaries this step-structure takes up a characteristic aspect in which two cases can be distinguished, namely: (a) simple or multiple evaporation spirals, or (b) evaporation channels. Interpretation in terms of twinning dislocations is given. ***E. Votava and A. Berghezan.*** *Acta Metallurgica*, v. 7, June 1959, p. 392-398.

13246 The Diffusion of Carbon During Precipitation in α-Iron. The activation energy for precipitation of C from α-Fe was measured to be 17.1 ± 0.5 kcal/mole by starting the precipitation at one temperature and finishing it at another. The activation energy was the same within experimental error for aging temperatures from 0 to 170 C, for samples strained up to 4%, and for samples of different concentration. This energy is appreciably smaller than that of 20.1 kcal/mole for C diffusion in α-Fe measured by elastic relaxation methods. ***R. H. Doremus.*** *Acta Metallurgica*, v. 7, June 1959, p. 399-402.

13247 Observations on Regular Arrays of Etch Pits in a Titanium-10% Molybdenum Alloy. Regular arrays of etch pits observed in rapidly cooled Ti-10% Mo alloys are considered to indicate the sites of unstable groups of dislocations which collapse, at slower rates of cooling, into a more stable network of sub-grain boundaries. ***T. H. Schofield and A. E. Bacon.*** *Acta Metallurgica*, v. 7, June 1959, p. 403-406.

13248 A Correlation of Data on Diffusion of Solutes in Face-Centered Cubic Metals. It is shown that the available data on the diffusion coefficients of substitutional solutes in dilute face-centered cubic solutions can be described approximately by an equation. This correlation, though not in strict accord with the nearest neighbor model for solutions, was suggested by it. ***D. Turnbull and R. E. Hoffman.*** *Acta Metallurgica*, v. 7, June 1959, p. 407-410.

13249 Grain Growth in Zone-Refined Tin. A single growth law obeying the simple $t^{1/2}$ relation was obtained over the range of temperatures 167-220 C. The activation energy for grain growth was calculated to be 6.0 ± 0.6 kcal/g atom, which is comparable to the previous result of 6.7 ± 0.7 kcal/g atom on zone-refined Pb. Application of the equation for grain growth yielded free energies of activation comparable in magnitude to those obtained in liquid self-diffusion. ***E. L. Holmes and W. C. Winegard.*** *Acta Metallurgica*, v. 7, June 1959, p. 411-414.

13250 Ternary Carbides of the Transition Metals Nickel, Cobalt, Iron, Manganese With Zinc and Tin. In the ternary systems Co-Sn-C, Fe-Sn-C, Ni-Zn-C, Co-Zn-C, and Fe-Zn-C double carbides were found that correspond to the formula T_3BC_y, where T is the transition metal. These compounds have an ordered face-centered cubic structure and together with the known compounds Mn_3SnC and Mn_3ZnC belong to the group of carbides reported previously. ***H. H. Stadelmaier and L. J. Huetter.*** *Acta Metallurgica*, v. 7, June 1959, p. 415-419.

13251* The Use of Controlled Solidification in Equilibrium-Diagram Studies. Two methods are described to yield the liquidus surface plus tie-lines for a polycomponent alloy. The first method yields this information experimentally, while the second method utilizes a combination of both experiment and theory. ***W. A. Tiller.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 555-559.

13252* Self and Interdiffusion in Liquid Zinc Amalgams. The self-diffusion coeffiicents of Hg and Zn were determined as a function of amalgam compositions between 0 and 1.6 wt. % Zn. The data show a satisfactory correlation with the Arrhenius relation. The data indicate the applicability of Darken's relation between self-diffusion and interdiffusion coefficients to diffusion in dilute liquid Zn amalgams. ***H. W. Schadler and R. E. Grace.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 559-566.

13253* Critical Particle Size for Precipitation Hardening. It is suggested that the critical particle size for peak yield stress is the size at which the particles begin to lose their complete coherence. A theoretical estimate of the size at which this should occur is in good agreement with that experimentally observed. ***J. D. Livingston.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 556-571.

13254* Edge-Nucleated, Growth Controlled Recrystallization in Aluminum. The recrystallization nuclei form colonies of grains strung along matrix grain edges. Only a small fraction of the total number of matrix edges produce colonies. The isothermal kinetics of the recrystallization are controlled by the two-dimensional growth of the colonies in the directions orthogonal to the nucleating edges. ***R. A. Vandermeer and Paul Gordon.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 4, Aug. 1959, p. 577-588.

13255* Comparison of the Thermal Stability of Some Precipitation-Hardened and Dispersion-Hardened Nickel-Base Alloys. Nickel alloy matrices hardened by precipitates of Ni_3Al, Ni_3Ti, or TiC overage rapidly at temperatures of 1340 F (727 C) and above. Nickel-base alloys hardened by finely dispersed particles of Al_2O_3 retain their high hardness of 250 to 400 Dph for very long times at 1340 F (727 C). ***D. H. Feisel and A. Cochardt.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 608-610.

13256* Influence of Thermal History on Preferred Orientations in the Recrystallization of Commercially Pure Aluminum. It was found that annealing of the crystals at 620 C prior to extension diminishes the recovery of the growth rate in recrystallization which explains another difference in the results of Graham and Cahn, and Liebmann et al. The latter group observed a strong decrease of growth rate with annealing time while in Graham and Cahn's experiments the growth rate remained constant. ***R. E. Green, Jr., B. G. Liebmann, and H. Yoshida.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 610-613.

13257* Solubility and Diffusion of Titanium in Iron. The values obtained from the maximum solubility of Ti in γ Fe by means of an X-ray analysis of multiphase diffusion couples are quite reasonable. The activation energy for the interdiffusion coefficient of Ti in α Fe, at low Ti concentrations, is essentially the same as the activation energy for the self-diffusion coefficient of Fe in α Fe. ***Sheldon H. Moll and Robert E. Ogilvie.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 613-618.

13258* Order-Disorder Transformation in Iron-Aluminum Alloys. The disordered Fe-Al alloys containing less than 23 at. % Al transform directly to Fe_3Al, but solve that concentration, they transform first to FeAl and then to Fe_3Al. The alloys can be magnetic in the disordered and in the Fe_3Al phase, but not as ordered FeAl. ***H. J. McQueen and G. C. Kuczynski.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 619-622.

13259* Correlation of Transformation Behavior With Mechanical Properties of Several Titanium-Base Alloys. Hardness, tensile, and X-ray diffraction data were compiled to follow the course of aging in the nominal alloys Ti-8Mn, Ti-8Mn-2Al, Ti-4Mn-4Al, Ti-6Al-4V, and Ti-4Fe. The Ti-Mn and Ti-Mn-Al alloys were embrittled after quenching from the α-β field and aging for short times at 800 or 900 F. Omega-phase patterns at this time were strong for the Ti-8Mn alloy, weaker and more diffuse for the Ti-8Mn-2Al alloy, and were not detected positively for the Ti-4Al-4Mn specimens. Omega was not observed on aging of the Ti-6Al-4V alloy. These data support previous observations that Al suppresses the formation of ω phase. ***A. J. Griest, J. R. Doig, and P. D. Frost.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 627-632.

13260* 1300°C Isotherm in the System Iron-Chromium-Nickel. The solubility limits in the Fe-Cr system at 1300 C were taken from the work of Adcock. The solubility of Cr in Ni at 1300 C was extrapolated from the interior of the diagram. Nickel solubility in Cr at this temperature is based on extrapolation along a smooth curve of the ferrite boundary. ***Peter E. Price and Nicholas J. Grant.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 635-637.

13261* Comments on the Determination, Analysis and Representation of Preferred Orientation. Experimental results of Chernock, Singer, Miller, Beck, and other authors are discussed. ***Robin O. Williams.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 646-647.

13262* Phase Changes in Precipitation Hardening Nickel-Chromium-Iron Alloys During Prolonged Heating. Use was made of X-ray and electron diffraction, electron microscopy, and the electron probe microanalyzer data. Equilibrium structure was not attained at 1500 F after 35,000 hr., during which time the principal age-hardening phase changed from face-centered cubic to hexagonal. ***C. C. Clark and J. S. Iwanski.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 648-651.

13263* The Association of Oxygen Atoms in Interstitial Solid Solution in Tantalum. Mechanical relaxation data are interpreted to show that an equilibrium exists in interstitial solid solutions of Ta between grouping of two O atoms and those O atoms which are not so bound together. The relaxation strength per O atom was found to be about twice as great for associated O atoms as for non-associated ones. ***R. W. Powers and M. V. Doyle.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 655-665.

13264* Controlling Grain Boundary Position in Growth From the Melt. Projections are machined on the bottom and cover of the boat, so that the Al specimen produced will have long grooves on two opposite sides along its length. ***R. L. Fleischer and R. S. Davis.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 665-666.

13265* Determination of the Cerium Habit in Carbon Steel. Vacuum-refined C steel melts containing specified amounts of S were exposed to various specified amounts of O and N after which Ce was added. It was determined that the Ce habit was predominantly a Ce sulfide. ***R. H. Singleton.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 675-679.

13266* Growth of Single Crystals of Stainless Steel. Crystal growth by strain anneal and from the melt are described. ***R. D. Leggett, R. E. Reed, and H. W. Paxton.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 679-680.

13267* Transformation Twins in Alpha Iron. Transformation twins, identified by their appearance on a polished and etched section, were found in zone-refined Fe, in several "high-purity" irons, and other brands. The coherent interfaces were planes. ***D. S. Hutton, G. L. Coleman, and W. C. Leslie.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 680-681.

13268* An X-Ray Method for the Determination of Beta Phase in a Titanium Alloy. The volume fraction of β phase was determined in a Ti-6Al-4V alloy by measurements of integrated diffraction intensities. The results indicate that little of the β phase is retained on quenching from the solution temperatures normally used for this alloy. ***B. L. Averbach, M. F. Comerford, and M. B. Bever.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 682-685.

13269* The Constitution of Delta-Phase Alloys of the System Uranium-Zirconium-Molybdenum. A ternary cut joining U-31.5 at. % Mo to U-74 at. % Zr is presented on the basis of differential thermal analysis, metallographic and X-ray diffraction data. Hypothetical isothermal ternary sections, inferred from the determined σ-phase relationships, are presented. A ternary eutectoid, at 454 C, was found in Zn-rich alloys. Its composition, based on metallography and electron-beam microanalysis, is estimated at U-61.7 at. % Zr-7.1 at. % Mo. ***M. S. Farkas, A. A. Bauer, and F. A. Rough.*** *American Institute of Mining, Metallurgical and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 685-693.

13270* The Solid Solubilities of Iron and Nickel in Beryllium. The maximum value of the solubility limit of Fe in Be was found to be 0.92 $\pm$ 0.02 at. % (5.46 wt. %) at the eutectic temperature 1225 C. The maximum solubility of Ni in Be was found to be 4.93 $\pm$ 0.01 at. % (25.2 wt. %) at the eutectoid temperature 1065 C. ***S. H. Gelles, R. E. Ogilvie, and A. R. Kaufmann.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 695-702.

13271* **Influence of Cobalt on the Transformation of a Chromium Alloyed Austenite.** It is shown that in 13 % Cr steels, Co retards the beginning of the pearlitic transformation and exhibits a different behavior as in eutectoid plain C steels. ***P. Nicolaides, D. Coutsouradis, and L. Habraken.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 702-705.

13272* **Activity of Carbon in Liquid-Iron Alloys.** The effects of elements on the activity coefficient of C in liquid Fe were studied by (1) equilibration with controlled mixtures of CO and CO_2; (2) the solubility of graphite in the melt. Activity coefficient of C is increased by Al, Co, Cu, Ni, P, Si, S, and Sn. It is decreased by Cr, Cb, Mn, Mo, W, and V. ***Tasuku Fuwa and John Chipman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 708-716.

13273* **Hydrogen in Cold Worked Iron-Carbon Alloys and the Mechanism of Hydrogen Embrittlement.** Cold working of Fe-C alloys was found to increase greatly the H solubility and to decrease the diffusivity at temperatures up to 400 C. Hydrogen embrittlement is explained by the Petch theory of metal crack surface energy loss due to H adsorption. ***M. L. Hill and E. W. Johnson.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 717-725.

13274* **Observations on the Niobium (Columbium)-Hydrogen System.** X-ray examination at room temperature of specimens reacted in H at high temperatures shows the presence of two phases—a bcc phase (α) based on the Nb lattice, and an orthorhombic phase. ***H. W. Paxton, J. M. Sheehan, and W. J. Babyak.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 725-727.

13275* **The Iron-Carbon Eutectoid Temperature.** The eutectoid temperature is 727.2 ± 0.5 C. This is higher than the generally accepted value 723 ± 2 C determined by Mehl and Wells. ***R. P. Smith and L. S. Darken.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 727-728.

13276* **The Effect of the Method of Preparation on Surface Structure.** Alterations in the surface layers which are produced by different methods of surface preparation make it difficult to give a complete specification of a particular surface. Surfaces used for research purposes are therefore only an approximation to an ideal surface. Examples are given of how thermally etched surfaces may have decorative possibilities and of surfaces prepared by ion bombardment which have a variety of potentially useful properties. ***A. J. W. Moore.*** *Australian Institute of Metals, Journal,* v. 4, no. 1, May 1959, p. 19-21.

13277 Composition Variations in Welds. Study of chemical and structural non-uniformity in junction zone of welded joints in pearlitic steels with a differences in composition between parent and weld metals. Conditions under which a transfer of C takes place. Factor governing the direction of this C transfer. Time and temperatures at which the chemical and structural non-uniformity manifests itself. ***L. S. Livshits, L. P. Bakhrakh, and S. I. Panich.*** *Henry Brutcher Translation No.* 4120, 8 pp. (From *Metallovedenie i Obrabotka Metallov,* no. 1, Jan. 1958, p. 26-28.) Henry Brutcher, Altadena, Calif.

13278 Electrolytic Extraction of Nonmetallic Inclusions From Steels by a Modified Klinger-Koch Method. Description of a modified Klinger-Koch apparatus with vertical diaphragm and other improvements. ***L. Brháček, J. Janáček, and A. Šmrhová.*** *Henry Brutcher Translation No.* 4495, 7 pp. (From *Hutnické Listy,* v. 14, no. 1, 1959, p. 54-55.) Henry Brutcher, Altadena, Calif.

13279 Decomposition of Nonmetallic Inclusions in [Liquid] Steel During Vacuum Treatment. Decrease of amount of inclusions of the MnO, MnO·FeO, Cr_2O_3, Cr_2O_3·FeO, silicate, and aluminate types. Relationship between extent of decomposition of inclusions and their thermodynamic stability. Conditions governing the rate of decomposition. ***A. F. Vishkarev and V. V. Kondakor.*** *Henry Brutcher Translation No.* 4598, 16 pp. (From *Proizvodstvo i Obrabotka Stali i Splavov.* Collection of Papers No. 38 from Moscow Steel Institute. Published by Metallurgizdat, Moscow, 1958, p. 196-208.) Henry Brutcher, Altadena, Calif.

13280 Diffusion of Radioactive Antimony in Silicon. The diffusion coefficient of radioactive Sb-124 in Si was investigated in the temperature range 1190 to 1398 C, with use of a technique involving measurement of the residual integrated activity of the 0.602 Mev γ before and after removing successive 2- to 4-μ layers perpendicular to the diffusion path. Results are compared to literature data obtained via p-n junction measurements. The diffusion coefficients are on the average about 85% higher than the literature values, while the activation energies are essentially the same. ***J. J. Rohan, N. E. Pickering, and J. Kennedy.*** *Electrochemical Society, Journal,* v. 106, Aug. 1959, p. 705-709.

13281* **Hardness of Martensite in Cast Iron in Relation to Carbon Content.** Effect of the graphite lamellas and P content. Effect of duration of austenizing temperature before quenching. Best hardness values were obtained when the temperature was maintained for 20 minutes, for a test specimen 16 mm. in diameter with 3.60% C, 1.66 Si, 0.62 Mn, 0.08 S, and 0.13 P. (*In French.*) Dureté de la martensite des fontes en fonction de sa teneur en carbone. ***Gabrielle Aubrion.*** *Fonderie, no.* 161, June 1959, p. 266-271.

13282 Radiation Damage in Ferrous Materials. Discusses annealing and structure of radiation damage. ***R. E. Smallman.*** *Iron & Steel,* v. 32, no. 7, June 1959, p. 321-322.

13283 Precipitation in Semiconductors. A brief review is given of the present status of precipitation phenomena in semiconductors. Recent theoretical advances in the analysis of diffusion-limited precipitation are described. The precipitation of Li and Si is discussed as an example of diffusion-limited precipitation in which metastable centers are observed, and the precipitation of Cu as an example to which formal nucleation theory appears to apply. A recent theory of the clustering of O in Si is described and its significance in terms of the nucleation process is indicated. It is emphasized that a number of techniques are now available for the observation of tiny aggregates of impurities in semiconductors, and the need for a consistently microscopic theory of nucleation is pointed out. ***A. G. Tweet.*** *Journal of Applied Physics,* v. 30, Aug. 1959, p. 1244-1248.

13284 X-Ray and Expansion Effects Produced by Imperfections in Solids: Deuteron-Irradiated Germanium. ***R. O. Simmons and R. W. Balluffii.*** *Journal of Applied Physics,* v. 30, Aug. 1959, p. 1249-1258.

13285 Electron Microscope Studies on the Etching of Irradiated Germanium. Electron microscope and electron diffraction studies on the surfaces of CP-4 etched Ge specimens show that the changes in etching behavior induced by fast neutron irradiation occur as a result of a gross change in chemical behavior and cannot be due to local variations in the etching rate in the vicinity of the structural defects introduced by the irradiation. Observations on network structures which are produced under certain conditions of etching indicate that these arise as a result of mechanical preparation of the surfaces or from changes in the etching process and are apparently unrelated to any prior substructure in the material. ***T. S. Noggle and J. O. Stiegler.*** *Journal of Applied Physics,* v. 30, Aug. 1959, p. 1279-1288.

13286 Grain Size Control During Ingot Solidification. Degree of superheat, nucleation catalysts, and solute elements are discussed. ***W. A. Tiller.*** *Journal of Metals,* v. 11, Aug. 1959, p. 512-514.

13287* **Transformation Temperatures and Structures in Uranium-Fissium Alloys.** On cooling from the gamma phase the U-3 wt. % Fs alloy undergoes a series of transformations involving the three allotropic forms of U and the U_2Ru and delta phases. The 5, 8 and 10 wt. % Fs alloys exhibit simpler transformation characteristics in that the formation of beta U is entirely suppressed. In all of these alloys the gamma solid solution exists as a stable phase down to 552 C. The general phase relations closely resemble those in the U-Mo-Ru ternary system. When additional Zr is added to the U-5 wt. % Fs alloy the compound ZrRu occurs instead of U_2Ru. ***M. V. Nevitt and S. T. Zegler.*** *Journal of Nuclear Materials,* v. 1, no. 1, Apr. 1959, p. 6-12.

13288* Cathodic Bombardment Etching of Nuclear Materials. A simple apparatus is described for cathodic etching by ionic bombardment. The etching conditions for a variety of metals, alloys and ceramics, including Th, U, UC, and NO_2, are reported. ***D. Armstrong P. E. Madsen, and E. C. Sykes.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 127-135.

13289* Effect of Fission Rate and Lamella Spacing Upon the Irradiation-Induced Phase Transformation of U-9 wt % Mo Alloy. Samples of U-9 wt. % Mo alloy of various U^{235} enrichments and interlamellar spacings were neutron irradiated at low temperatures, and the kinetics of the neutron-induced phase transformation determined by electrical resistivity measurements. The kinetics of this reaction may be described in terms of macroscopic diffusion occurring within a "displacement" or a "thermal spike". The diffusion coefficient was determined and found to be directly proportional to the fission rate, but independent of sample temperature between −90 and +200 C and of neutron flux intensity. ***M. L. Bleiberg.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 182-190.

13290* Equilibrium Diagrams With InSb as One Component. Three equilibrium diagrams formed from InSb with Sn, Ge, and GaSb respectively were investigated by thermal, X-ray, and metallographic techniques, and a diagram for each system is given. In both the InSb-Sn and InSb-Ge systems, there is evidence for the occurrence of a three-phase field, indicating that these diagrams can not be treated as quasi-binary. ***J. C. Woolley and D. G. Lees.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 192-198.

13291* Equilibrium Diagram of the Ga_2Te_3-In_2Te_3 System. Complete solid solution occurs throughout the whole range of composition, but the form of the liquidus and solidus curves show that the section is not quasi-binary and must be treated as a general section of the ternary system. ***J. C. Woolley, D. G. Lees and B. A. Smith.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 199-201.

13292* The Uranium Monocarbide-Uranium Mononitride System. The system was investigated by metallographic and X-ray diffraction techniques. Alloys were prepared by arc-fusion and by solid-state diffusion. From the lowest temperature investigated, 1200 C, upwards, the carbide and nitride form a continuous series of solid solutions. At 1200 C, the alloys prepared by solid-state diffusion obey Vegard's law, but those prepared by fusion deviate from this law in a systematic fashion. The results of X-ray diffraction studies of the diffusion process suggest that homogenization occurs by solution of the carbide in the nitride, but not by the reverse process. ***J. Williams and R. A. J. Sambell.*** *Journal of the Less-Common Metals*, v. 1, no. 3, June 1959, p. 217-226.

13293* Solidification Mechanisms of Eutectic and Gray Iron. Homogeneous and heterogeneous nucleation; single phase and polyphase systems; eutectic solidification and resulting structures; normal and abnormal eutectics; second phase and minor phase spheroid solidification; eutectic solidification of gray iron; eutectic cells; C diffusion. ***Albert De Sy.*** *Modern Castings*, v. 36, Aug. 1959, p. 76-82.

13294* Formation of ε-Martensite During the Plastic Deformation of Steel. During the deformation of austenitic stainless steel a hexagonal ε-phase is formed which is an intermediary link in the $\gamma \rightarrow \varepsilon \rightarrow \alpha$ chain in some (usually low) stages of deformation. Formation of ε-martensite during deformation is due to the N and other elements in the γ solid solution obtained during low tempering temperatures and annealing in a vacuum. (*In Russian.*) Obrazovanie ε-martensita pri plasticheskoĭ deformatsii stali. ***A. P. Guliaev and Ia. E. Sanchuk.*** *Nauchnye Doklady Vysshei Shkoly, Metallurgiia*, 1959, no. 2, p. 181-185.

13295* Anti-Phase Domains in Gold-Copper-Zinc Ordered Alloys Revealed by Electron Microscope. Using thin evaporated films, the line-up of anti-phase domains was observed as parallel lines on transmission electron micrographs of bright field, down to a domain size of about 8Å. The lattice modulation accompanying anti-phase domains was verified to play an important role in forming the satellites around the direct spot on a diffraction pattern. Two-thirds of the intensity of the satellites was estimated in the present alloy films to arise from the modulation, and the remainder probably from double diffraction. ***Shiro Ogawa, Denjiro Watanabe, Hiroshi Watanabe, and Tsutomu Komoda.*** *Physical Society of Japan, Journal*, v. 14, July 1959, p. 936-941.

13296 Electronic Band Structure of Solids by X-Ray Spectroscopy. General aspects including advantages and disadvantages and two energy regions; resolving power and corrections; energy level diagram, experimental curves and interpretations. ***L. G. Parratt.*** *Reviews of Modern Physics*, v. 31, no. 3, July 1959, p. 616-645.

13297 Symposium on Advances in Electron Metallography. Papers presented at the Sixty-First Annual Meeting, Boston, Mass., June 24, 1958, on specimen preparation and structure of Ti, Al, Ni, and other alloys. 120 pp. 1958. American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13298 Techniques Employed in the Electron Microscope Study of Titanium Alloy With 8 Per Cent Manganese. Paper from "Symposium on Advances in Electron Metallography", p. 3-23, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13299 Examination of Metals by Transmission Electron Microscopy. Using an RCA-2C electron microscope operating at 50 kv it is possible to observe individual dislocations, stacking faults, and secondary phases in suitable metal foils. In general, the dislocations cannot be caused to move by localized heating with the electron beam. It appears that the technique is applicable to the study of dislocations and phase transformations in any material that can be satisfactorily electropolished. ***F. W. C. Boswell and E. Smith.*** Paper from "Symposium on Advances in Electron Metallography", p. 31-42, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13300 A Study of Dislocations in Thin Aluminum Foils Elongated in the Electron Microscope. It is shown experimentally that Al foils not thicker than 2000 Å can be deformed plastically while under observation in the electron microscope, and that it is thereby possible to study the behavior of dislocations in considerable detail. ***H. G. F. Wilsdorf.*** Paper from "Symposium on Advances in Electron Metallography", p. 43-67, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13301 Microstructure of Age-Hardenable Alloys. Studies on common Ni-Cr alloys hardened with Al and Ti. ***J. R. Mihalisin and K. G. Carroll.*** Paper from "Symposium on Advances in Electron Metallography", p. 68-72, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13302 An Electron Metallographic Study of the Precipitation-Hardening Process in Commercial Nickel-Base Alloys. Electron metallographic studies have been made of the commercial alloys Inconel-X, Waspaloy, M-252, and Udimet-500 aged at 1400 and 1600 F for periods up to 100 or 1000 hr. Electron micrographs showing the development of the γ phase as a function of aging are presented, and possible relationships between the precipitation process and the variations of the hardness of the alloys during aging are discussed. ***W. C. Bigelow, J. A. Amy, C. L. Corey, and J. W. Freeman.*** Paper from "Symposium on Advances in Electron Metallography", p. 73-87, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13303 The Application of Electron Diffraction and Electron Microscopy in Studies of Minor Phases of Heat-Resistant Alloys. The method of Heidenreich, combining electron diffraction and electron microscopic examinations of etched surfaces for identifying and studying the distribution of minor phases of metal systems, has been applied to heat-resistant alloys. General considerations in preparation of surfaces of these alloys for electron metallographic examination are discussed. Applications of the method to four typical alloys, 16-25-6, Inconel-X, S816, and N-155, are described. ***W. C. Bigelow, L. O. Brockway, and J. W. Freeman.*** Paper from "Symposium on Advances in Electron Metallography", p. 88-99, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13304 Electron Probe Analysis of Segregation in Inconel. Electron probe microanalysis of precipitates in Inconel-X high-temperature alloy showed that the submicron grain boundary

precipitates were rich in Cr but poor in other metallic elements. Precipitates several microns in size that formed in the matrix material or near grain boundaries were rich in Cb and Ti, but poor in Cr. The Ti and Cb content was not uniform from one precipitate to another or even within a single precipitate, and some precipitates showed a definite coring effect with a rich layer of Cb surrounding a Ti core. ***E. J. Brooks and L. S. Birks.*** Paper from "Symposium on Advances in Electron Metallography", p. 100-105, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

13305 Selected Etchants for Electron Microscope Studies of Magnesium Alloys. ***C. A. Moe.*** Paper from "Symposium on Advances in Electron Metallography", p. 106-120, 1958, American Society for Testing Materials, Philadelphia. (TN690 Am35.7s)

See also: **13141** (nucleation in cast iron); **13184** (dislocations in β-uranium); **13207** (recrystallization in Mo alloys).

METALS—POWDER

13306* On the Conductivity of Disperse Mixtures With Imperfect Contacts Between the Particles. Calculations based on the theory of electrical contacts and an analogy between contact resistance and poor conductive film resistance. Method is applicable to mixtures of any concentration and any number of phases. (*In Ukrainian.*) Pro providnist' dispersnikh sumishei z nedoskonalimi kontaktami mizh chastinkami. ***V. V. Skorokhod and I. M. Fedorchenko.*** *Akademiia Nauk Ukrains'koi RSR, Dopovidi,* 1959, no. 7, p. 756-759.

13307* Observations on the Structure and Sintering Mechanism of Cemented Carbides. The sintering of cemented carbides takes place in two stages: (a) transport of particles through the liquid binder and (b) grain growth and coalescence of carbide grains. The structure of sintered carbides changes during sintering by the formation of contacts between carbide grains subject to interfacial energy relations. ***J. Gurland.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 4, Aug. 1959, p. 601-608.

13308 Alloying of Metal Borides With Silicon. Study of effect of additions of silicides of metals having volatile oxides, or of elementary Si upon the oxidation resistance of binary Ti-Cr borides, i. e. (Ti, Cr) B_2 with a TiB_2/ CrB_2 ratio of 4/1. Explanation of dissimilar effects exerted by addition of elementary Si as against silicides of Mo or W. ***K. I. Portnoi, G. V. Samsonov, and K. I. Frolova.*** *Henry Brutcher Translation No.* 4611, 10 pp. (From *Izvestiia Akad. Nauk, SSSR, Otd. Tekh. Nauk, Met. i Topl.*, Mar.-Apr. 1959, p. 117-121.) Henry Brutcher, Altadena, Calif.

13309 Metal Powders Give Lead Strength. Development of high temperature lead-cemented alloys; uniform dispersion is key to strength. *Chemical and Engineering News,* v. 37, no. 32, Aug. 10, 1959, p. 50-51.

13310 Electrolytic Iron Powder From a Caustic Soda Solution. Conditions for electrolytic deposition of Fe powder from a slurry of iron III oxide in caustic soda solutions were investigated. The variables that influence the deposition the most were temperature (90 C), caustic soda concentration (600-800 g/l), and low current densities. A ductile, dendritic deposit was obtained that could be ground up easily. The size of the dendrites was influenced greatly by conditions of deposition. ***J. Adrien, M. LeDuc, Richard E. Loftfield, and Luther E. Vaaler.*** *Electrochemical Society, Journal,* v. 106, Aug. 1959, p. 659-667.

13311 Effects of Thickness of Tension Test Specimen for Sintered Metals on Tensile Strength and Elongation of the Materials. Tests on specimens pressed from Swedish sponge Fe powders. ***Etsuo Hayashi.*** *Proceedings of the First Japan Congress on Testing Materials,* 1958, p. 89-92. (TA410 J27p)

13312 Fiber Metallurgy: New Opportunities for Metalworking? Porous products can have high strength, temperature, and corrosion resistance and be permeable. Composites of metals and ceramics with good properties are a possibility. ***Steel,*** v. 145, Aug. 10, 1959, p. 126-128.

13313* New Achievements of Powder Metallurgy. Recent results which were achieved in manufacturing steel parts impregnated with Cu. New methods of improving the strength properties of parts made of steel powder by adding P and Mn. (*In Czech.*) Novinky z práškové metalurgie. ***Z. Ministr. Strojírenství,*** v. 9, no. 7, July 1959, p. 525-527.

13314* The Effect of the Symptoms of Aging on the Characteristic Values of Metal Powders. Silver powder samples of different origin were investigated and the change of sintering properties, grain-size distribution, and compressibility with storage time were studied. The characteristic properties of powder can be kept constant by a short heat treatment, which reduces the fusibility of the material. (*In German.*) Der Einfluss von Alterungserscheinungen auf die Kennwerte von Metallpulvern. ***Martin Clasing.*** *Zeitschrift für Metallkunde,* v. 50, July 1959, p. 424-428.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

13315* Ultrasonic Image Camera. Description and operation of ultrasonic inspection system. ***Ronald A. Cole.*** *Aircraft and Missiles Manufacturing,* v. 2, Sept. 1959, p. 44-45.

13316 Progress in Non-Destructive Testing. Recent developments in industrial radiography, stress wave propagation, electromagnetic methods of testing metals, neutron radiography, medical aspects of non-destructive testing, applications of damping capacity for investigating the structure of solids, thermal conductivity as a testing technique, and nuclear magnetic resonance and its application to the testing of materials, are discussed. ***E. G. Stanford and J. H. Fearon, editors.*** 267 pp. 1958. Heywood & Company, London. (TA401 p94)

See also: **13154** (quality control in brass foundry); **13490** nuclear explosion detection); **13638** (inspection of ship welds).

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

13317* On the Excited Levels of Pt^{192}. The 784 keV energy level of Pt^{192} decays partly by 468 keV E2 radiation into the 316 keV excited level, partly by 784 keV E4 radiation into the ground state. ***L. Keszthelyi and J. Zimányi.*** *Acta Physica Academiae Scientiarum Hungaricae,* v. 10, no. 1, 1959, p. 1-6.

13318* Problems of Multiple Particle Emission. Qualitative features, nuclear particles are discussed. Possible qualitative model is established for the description of events. Measurements are proposed in order to clarify further the characteristics of the process. ***G. Domokos.*** *Acta Physica Academiae Scientiarum Hungaricae,* v. 10, no. 1, 1959, p. 7-17.

13319* Some Remarks on the Generation of Nuclear Power by Controlled Fusion Processes. Energy production and the radiation losses of a thermonuclear system are discussed. A diagram is given with the help of which the number of fusions and energy production per sec and cm^3 at any plasma density and for suitable temperatures can be determined. Discussion on the operational conditions of the possibly practicable thermonuclear reactors is included. ***A. Szalay and D. Berényi.*** *Acta Physica Academiae Scientiarum Hungaricae,* v. 10, no. 1, 1959, p. 39-55.

13320* Nucleon-Surface Interaction and the (p,n) Reactions. Effective contribution to the neutron-proton potential due to the proton-core (surface) - neutron coupling and the proton (neutron) - surface selfaction couplings are calculated.

These corrections being of the second order in the B.-M. coupling constant appear as a part of the total (p,n) transition operator. The Coulomb effect of the incident proton wave is taken into account. ***J. Sawicki and Z. Szymański.*** *Acta Physica Polonica*, v. 17, no. 1, 1958, p. 21-28.

13321* Semiclassical Description of Scattering. Types of scattering discussed are: interference, rainbow scattering, glory scattering, and orbiting. ***Kenneth W. Ford and John A. Wheeler.*** *Annals of Physics*, v. 7, July 1959, p. 259-286.

13322* Some Prospects for the Production and Observation of New Particles. ***Bernard T. Feld.*** *Annals of Physics*, v. 7, July 1959, p. 323-348.

13323* On the General Theory of Collisions for Particles With Spin. The general analysis of binary reactions involving particles with arbitrary spin is reformulated in such a way that it applies equally well to relativistic particles (including photons). This is achieved by using longitudinal spin components ("helicity states") not only in the initial and final states, but also in the angular momentum states which are employed as usual to reduce the S-matrix to a simpler form. Gives expressions for the scattering and reaction-amplitude, intensity and polarization. ***M. Jacob and G. C. Wick.*** *Annals of Physics*, v. 7, Aug. 1959, p. 404-428.

13324* Angular Distribution of Polarized Electrons Emitted From Oriented Nuclei. A procedure first used by Rose and Osborn is applied to the calculation of the angular distribution of polarized electrons emitted from oriented nuclei. The final result is an exact expression in which the only unknown quantities are the reduced matrix elements. The latter can be evaluated only after a definite nuclear model is adopted. ***Hormoz Mahmoud.*** *Annals of Physics*, v. 7, Aug. 1959, p. 429-439.

13325* Analytic Properties of the Amplitude for the Scattering of a Particle by a Central Potential. A new proof is given that the scattering amplitude, considered as a function of energy, for fixed momentum transfer, has those analytic properties in the energy variable which imply a dispersion relation. The proof is based on the known behavior of the Green's function, as the resolvent of a self-adjoint transformation, and on the study of the Born series. ***Abraham Klein and Charles Zemach.*** *Annals of Physics*, v. 7, Aug. 1959, p. 440-455.

13326* A Shell Model Calculation With Reaction Matrix. An approximate form for the reaction matrix has been used to calculate the level spacings of Ca^{42}. The reaction matrix has been parametrized with two quantities. One is the correlation length and the other is a quantity related to the effective mass. Reasonable agreement between the experimentally measured level spacings and the theoretical values are obtained for values of the two parameters which are consistent with the estimates of these quantities based on the studies of the properties of nuclear matter. ***Manoj K. Banerjee and Binayak Dutta Roy.*** *Annals of Physics*, v. 7, Aug. 1959, p. 484-503.

13327* Measurements on Halogen-Quenched Counters. Gas amplification factor of a cylindrical counter filled with Ne-Br and A-Br mixtures. Transit time of electrons was found to be less than 0.2 microseconds. Duration and the mechanism of the discharge build-up was found to change with the amount of Br present. ***D. H. Le Croissette.*** *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 7, no. 6, 1959, p. 409-416.

13328* A Note on the Confinement of Charged Particles by a Magnetic Field. ***B. Lehnert.*** *Arkiv för Fysik*, v. 15, no. 6, 1959, p. 579-582.

13329* Present Stage of Development of Gas-Cooled Factors for High Temperatures. Short review from development of gas-cooled reactors and indicates some of the problems, which are opposite the achievement of high temperatures, and shows some proposals to overcome these difficulties. (*In German.*) Der heutige Stand der Entwicklung von gasgekühlten Reaktoren für hohe Temperaturen. ***A. Thiel.*** *Atomkernenergie*, v. 4, June 1959, p. 241-244.

13330* Fuel Elements for Gas-Cooled Reactors. One will expect only a slight increase of temperature changing over from the compact U metal rod to the U metal tube or to the plate-shaped fuel element. The transition to ceramic fuels offers besides possibility of an essentially greater rise of temperature, also in other respects more advantages than disadvantages. Materials for canning must have at the elevated temperatures a sufficient high temperature strength and be noncorrosive. Metal and ceramic materials capable for this are discussed. For highest temperatures, preferably graphite is applicable. (*In German.*) Brennelemente für gasgekühlte Reaktoren. ***M. Becker.*** *Atomkernenergie*, v. 4, June 1959, p. 244-246.

13331* Formation of Mercury −197, −195, and −194 Isotopes by Reaction of 155 MeV Protons on Gold. (*In French.*) Formation des isotopes 197, 195 et 194 du mercure par réaction de protons de 155 MeV sur l'or. ***Nina Poffé, Michel Riou, and Jean Teillac.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 248, no. 25, June 22, 1959, p. 3552-3554.

13332* Transitory Phenomenons and Nuclear Relaxation of Optically Oriented ^{199}Hg. On establishment of the nuclear orientation of ^{199}Hg, the transitory phenomenona permit the measurement of the longitudinal time of relaxation T_1. One can also observe optically the "mutation" of nuclear spins of ^{199}Hg in a magnetic resonance and deduct from it the time of transversal relaxation T_2. (*In French.*) Phénomènes transitoires et relaxation nucléaire de ^{199}Hg orienté optiquement. ***Bernard Cagnac and Jean Brossel.*** *Comptes Rendus Hebdomadaries des Séances de l'Académie des Sciences*, v. 249, no. 2, July 15, 1959, p. 253-255.

13333* Nuclear Radiation Effects on Electrical Ceramics. Tabulates results of several programs that have evaluated the nature and extent of radiation damage to ceramics. ***William E. Rowe and J. R. Johnson.*** *Electrical Manufacturing*, v. 64, Aug. 1959, p. 93-97.

13334 Explaining the Atom. ***Selig Hecht.*** Rev. Ed. 226 pp. 1957. The Viking Press, New York. (QC778 H35e)

13335 Radiation Effects in Silicon Solar Cells. Estimate of the number of atoms displaced from normal sites by Compton electrons from Co^{60} gamma rays and by slow and fast neutrons. Changes in carrier lifetimes and mobilities are used to predict the performance of a Si solar cell under gamma and neutron irradiation. Effect of annealing is considered. ***F. A. Junga and G. M. Enslow.*** *IRE Transactions on Nuclear Science*, v. NS-6, no. 2, June 1959, p. 49-53. (TK1 In6.6ns Vis.)

13336* Longitudinal Polarisation of Beta Particles From Rb^{86}, Pr^{144} and Co^{60}. An experimental set up is described for converting longitudinal polarization of beta particles to transverse polarization and for determining the degree of polarization, using the method of Mott scattering from a thin gold foil. Electron polarization in the energy range 90 to 150 KeV can be studied. The degree of polarization for beta particles of energy 110 KeV from Co^{60} Pr^{144}, and Rb^{86} has been determined and is seen to be equal to $-V/C$, within the limits of experimental error. ***M. C. Joshi, V. G. Kulkarni, C. V. Panat, and B. V. Thosar.*** *Indian Academy of Sciences, Proceedings*, v. 49, sec. A, no. 6, June 1959, p. 322-325 + 1 plate.

13337 Small Nuclear Electric Power Device Developed. Illustrates the radioisotope fueled generator based on Po-210 decay. *Industrial Heating*, v. 26, Aug. 1959, p. 1536 + 1 page.

13338* A Two Beam Betatron on 25 Mev. Description of tests relative to selection of type of winding and cooling systems of a new betatron of the Tomsk Polytechnical Institute. Industrial 50 hz frequency is used permitting a radiation dosage up to 50 to 60 Röntgen per minute at a distance of one meter. (*In Russian.*) Dvukhluchevoĭ betatron na 25 Mev. ***E. M. Belov, B. I. Gorbunov, A. I. Kuznetsov, B. N. Titov, and I. V. Shipunov.*** *Izvestiia Vysshikh Uchebynkh Zavedeniĭ, Elektromekhanika*, v. 2, no. 1, 1959, p. 123-128.

13339* Fine α Ray Structure of ^{210}Bi(RaE). Determined by means of magnetic spectrography. Observed with following energy and abundance : 4,686 MeV, $0{,}5.10^{-6}$ and 4,649 MeV, $0{,}75.10^{-6}$. (*In French.*) Structure Fine α DU ^{210}Bi(Ra E). ***R. J. Walen and G. Bastin-Scoffier.*** *Journal de Physique et le Radium*, v. 20, no. 6, June 1959, p. 589-593.

13340 Radiation Effects in Materials. A review is given of the mechanisms of radiation damage, and of some of the resulting effects. The discussion is divided into three categories: (1) mechanisms of damage production, (2) nature and mobility of the imperfections produced, (3) effect of the imperfections on the measurement of the properties of the solid. Principal attention is given to metals, with related observations in semiconductors cited. ***Harvey Brooks.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1118-1124.

13341 Some Consequences of Thermal Neutron Capture in Silicon and Germanium. The average value of the kinetic energy of recoil following thermal neutron capture and subsequent gamma-ray emission is 780 ev in Si and 180 ev in Ge. For every neutron captured in Si, 0.04 P^{31} atom (therefore, 0.04 excess electron) are formed by radioactive decay. ***H. C. Schweinler.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1125-1126.

13342 Magnetic and Electrical Properties of Reactor-Irradiated Silicon. Magnetic susceptibility measurements above 3 K and Hall effect and resistivity determinations between 50 and 300 K are reported for *n*-type Si samples irradiated with increasingly higher doses of fission neutrons. The paramagnetism due to electronic states in the forbidden gap shows an initial decrease after short irradiation but a reversal, increase, and final saturation at a value less than that originally contributed to the paramagnetism by the filled donors after longer irradiation. ***E. Sonder.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1186-1194.

13343 Cross Sections for Atomic Displacements in Solids by Gamma Rays. Cross sections for the displacement of lattice atoms by gamma rays for energies up to 5 Mev have been calculated. The principal contribution is found to come from the Compton effect, in which the atoms are displaced by electrons produced by the incident gamma rays. The calculations have been based on the assumption of a sharp threshold energy for displacement, but cross sections have been computed as a function of the assumed threshold energy. Thus, from the present work it is relatively easy to obtain cross sections based upon other displacement functions. ***O. S. Oen and D. K. Holmes.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1289-1295.

13344 Radiation Damage in Ferrous Metals. Through the selection of illustrative data, the author presents a picture of iron and steels under irradiation. The greater portion of the work done has been of an engineering nature, and the conditions of irradiation, temperature, and exposure time do not cover ranges as large as might be desired ***D. E. Thomas.*** *Journal of Metals*, v. 11, Aug. 1959, p. 523-527.

13345* An Evaluation of the Beryllia-Water Vapor Reaction in an Open-Cycle Air-Cooled Reactor. ***R. L. McKisson.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 196-202.

13346* Evaluation of the Volume of a Point of Fission in Uranium. (*In French.*) Evaluatiin du volume d'une pointe de fission dans l'uranium. ***Y. Quéré and F. Nakache.*** *Journal of Nuclear Materials*, v. 1, no. 2, July 1959, p. 203-209.

13347* Pion-Baryon Interactions and "Closed Loop" Phenomena. Effect of strong pion-hyperon interactions on $\pi^0 \rightarrow 2\gamma$ decay and π-π interaction is examined. While the interaction of pions with hyperons helps to reduce the decay rate of π^0, it leads to an unreasonably strong π-π attraction. To reduce the attraction it is suggested that either the meson-meson divergence should not be renormalized or π-K interactions of the Yukawa type should be invoked. ***A. N. Mitra.*** *Nuclear Physics*, v. 12, no. 2, July 1959, p. 133-138.

13348* A New Isotope of Terbium, an Alpha Emitter of Mass 152. Produced by ^{151}Eu(α, 3n) and ^{152}Gd(p,n) reactions. Its half-life is found to be 4 ± 0.5 minutes. This isotope decays by electron-capture, β^+ and α rays. The ratio α/X_K is ≈ 2 x 10^{-5}. 140-keV and 235-keV γ-rays are observed. (*In French.*) Un nouvel isotope du terbium de masse 152, émetteur alpha. ***J. Olkowsky, I. Gratot, M. Le Pape, and L. Cohen.*** *Nuclear Physics*, v. 12, no. 2, July 1959, p. 159-166.

13349* Energy Dependence of the (p,n) Reaction Near $A = 70$. Measurements for elements near the size-resonance in the proton strength function have been made. It is shown that the (p,n) reaction is not always a good measure of the total reaction cross-section. The measurements made confirm that the size-resonance is for s-wave protons and that a radius $R = 1.45$ $A^{⅓}$ x 10^{-13} cm is suitable for computation of barrier penetrabilities. ***G. A. Jones.*** *Nuclear Physics*, v. 12, no. 2, July 1959, p. 167-181.

13350 Nuclear Reactions. Study of those reactions in which the initial state has two components: the target nucleus and the bombarding particle or radiation. Only bombarding energies are considered below the threshold for the production of "strange" particles, such as mesons, anti-nucleons, or hyperons. ***P. M. Endt and M. Demeur, editors.*** v. I. 493 pp. 1959. Interscience Publishers, New York. (QC794 En25n)

13351* Approximate Analysis of Reactor Start-up Incidents. Formulas are given for the inverse reactor period at the time when the power reaches the trip level. Results are derived for the total energy generation in the absence of a scram. ***H. Hurwitz, Jr.*** *Nuclear Science and Engineering*, v. 6, July 1959, p. 11-17.

13352* Gamma and Neutron Heating in and About a Homogeneous Reactor. A hand calculational procedure is described. In a medium-Z element, such as Mo, the γ heating is four times more per unit mass than it is for a substance such as graphite. ***Raymond Fox.*** *Nuclear Science and Engineering*, v. 6, July 1959, p. 33-36.

13353* Fabrication of Zircaloy-2 Channels for Vallecitos Boiling Water Reactor Fuel Assemblies. A process for fabricating square-shaped zircaloy-2 channels for the fuel assemblies used in the Vallecitos Boiling Water Reactor. Welds made using this process were as good as those produced in a controlled atmosphere box from the point of view of corrosion resistance and mechanical integrity. ***C. N. Spalaris.*** *Nuclear Science and Engineering*, v. 6, July 1959, p. 37-43.

13354 Injection Into Thermonuclear Machines Using Beams of Neutral Deuterium Atoms in the Range From 100 kev to 1 Mev. Injection into a steady magnetic mirror machine by ionization of a beam of neutral deuterium atoms is analyzed. If the neutral beam is switched on in a sufficiently good vacuum, then the trapped plasma density will build up to a steady-state value of interest for experimental study. ***G. Gibson, W. A. S. Lamb, and E. J. Lauer.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 937-940.

13355 Diffusion, De-Excitation, and Three-Body Collision Coefficients for Excited Neon Atoms. Diffusion coefficients, de-excitation cross sections, and three-body collision coefficients for neon atoms of the $1s^2 2s^2 2p^5 3s$ configuration are obtained from optical absorption measurements of relative decay rates and relative densities of excited atoms following a pulsed discharge. ***A. V. Phelps.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1011-1025.

13356 Cross Sections for the $Li^7(n,\gamma)Li^8$ Reaction. The neutron radiative capture cross section of Li^7 was measured for neutron energies between 40 and 1000 kev and at thermal energy. The reaction was detected by observing the beta decay of Li^8 in a natural LiI crystal exposed to a flux of monoenergetic neutrons. The cross sections for the $Li^7(n,\gamma)Li^8$ reaction were obtained relative to the known cross sections for the $Li^6(n,t)He^4$ and the $I^{127}(n,\gamma)I^{128}$ reactions which also took place in the crystal. The $Li^7(n,\gamma)$ cross section decreases from a value of 50 x 10^{-6} barn at 40 kev to 5 x 10^{-6} barn at 1000 kev. A maximum in the cross section was found at 250 kev, corresponding to a known level in Li^8 at 2.28 Mev. The observed radiation width of this level was 0.07 ± 0.03 ev. ***W. L. Imhof, R. G. Johnson, F. J. Vaughn, and M. Walt.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1037-1039.

13357 Elastic Scattering of Deuterons From Mg, Al, Ti, V, Cr, Co, Ni, and Cu. Angular distributions were measured at laboratory energies of 3.32 and 4.07 Mev. The measured cross sections show a smooth decrease below the Rutherford cross section for scattering angles greater than some critical angle which increases with increasing A and decreasing deuteron energy. Cross sections calculated with an optical model show satisfactory agreement with the measurements. The dominant feature of the model is the large imaginary part of the potential, implying strong absorption of deuterons interacting with the

nucleus. From the measurements, however, it does not appear possible to identify the reaction mechanism giving rise to this absorption. ***I. Slaus and W. Parker Alford.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1054-1060.

13358 γ-Transitions Between Corresponding States in Mirror Nuclei. Charge independence or charge symmetry give rise to the following relations connecting the strengths of γ-transitions between corresponding states in mirror nuclei: (a) the strengths of corresponding *E*l transitions are always equal; (b) the strengths of corresponding *M*l transitions should not differ in general by more than a factor 1.5; (c) for transitions with $|\Delta T| = 1$ the strengths of corresponding transitions of any multipolarity are equal. ***G. Morpurgo.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1075-1080.

13359 Nuclear Spectroscopy of Odd-Mass (161-173) Nuclides Produced by Proton Irradiation of Er and Yb. To study the effect of nucleon number on nuclear levels of odd-mass rare-earth isotopes, enriched isotopes of Er and Yb were irradiated with protons in the ORNL 86-inch Cyclotron. After chemical separation, the decay chains leading to stable isotopes were analyzed with internal-conversion, photographic-recording, permanent-magnet spectrographs. Precise energy values as well as photometrically measured intensities of conversion lines of 8 to 1600 kev energy were obtained. ***B. Harmatz, T. H. Handley, and J. W. Mihelich.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1082-1094.

13360 Photoproton Cross Sections of Carbon. The partial (γ,p) cross section of C in which the residual B nucleus is left in the ground state has been measured with a thin-crystal proton spectrometer. This cross section is shown to decrease from about 10 mb at the giant resonance peak (22 Mev) to about 0.1 mb near 60-Mev photon energy. ***S. Penner and J. E. Leiss.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1101-1109.

13361 Proton Elastic Scattering Cross Sections of Si, Cl, K, Sc, Ti, and Mn. The proton elastic scattering yields of Si, Cl, K, Sc, Ti, and Mn have been determined with respect to that from Cu in the energy range 1.0-2.0 Mev at 150° laboratory angle. Two large resonances were found in Si and two smaller ones in chlorine. The smooth regions of the curves do not vary significantly from the Rutherford values. ***Sylvan Rubin, L. Evan Bailey, and Thomas O. Passell.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1110-1114.

13362 Photonuclear Cross Sections for A^{40}. The (γ,p), (γ,np), (γ,n), and $(\gamma,2n)$ cross sections for A^{40} are presented. The (γ,p) cross section has a peak at 23.5 Mev while the (γ,n) cross section peaks at 16.5 Mev and the $(\gamma,2n)$ peaks at 20 Mev. The (γ,np) cross section peaks at 27.5 Mev. The total absorption cross section for A^{40} has a peak height of 86 mb at 23.5 Mev and a full width at half maximum of 10.3 Mev. ***A. S. Penfold and E. L. Garwin.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1139-1142.

13363 Mass-550 Particle. At an altitude of 2550 m, a search has been carried out for the 500-mass particle which, at the Moscow International Conference in May, 1956, was reported to exist with an abundance of 0.5% relative to muons of the same range. Preliminary evidence against this datum is now reinforced by the results of a new series of measurements in which particles heavier than pions but lighter than protons are selected by means of two Čerenkov counters. The mass of each selected particle is derived from measurements of energy loss in a proportional scintillator, and range in a large multiplate cloud chamber. The latter alone yields substantial information on the nature of the stopping particles. No example of a mass-550 particle has been found out of the 25 expected on the basis of the reported abundance. ***M. Conversi, et al.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1150-1151.

13364 Space-Time Properties and Internal Symmetries of Strong Interactions. Theorems relating the separate conservation of *C* and *P* in pion-nucleon interactions to *Cp* invariance, the form of the interaction and the existence of a charge symmetry operation are generalized to other strong interactions. It is shown that the minimal conditions for the derivation of such results are the existence of a doublet structure for baryons and invariance under certain transpositions of the baryons that may be interpreted as generalized charge symmetries relating the different doublets and may be represented by reflection operations in an internal 4-dimensional space. ***Gerald Feinberg and Feza Gürsey.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1153-1170.

13365* The Elastic Scattering of High Energy Neutron by Deuteron. Used two-body scattering amplitudes and the deuteron wave functions calculated making use of the meson theoretical potential. ***Yoshiyuki Sakamoto and Tatuya Sasakawa.*** *Progress of Theoretical Physics*, v. 21, no. 6, June 1959, p. 879-901.

13366* Reactor Core Materials. Fuel and Fertile Materials. Discussed are fuel and fertile materials, moderator materials, control materials, cladding and structural materials, and special fabrication techniques. *Reactor Core Materials*, v. 2, no. 2, May 1959, 57 pp.

13367* Reactor Fuel Processing. Commercial aspects; preparation; research and development; waste disposal; production of U, Th, Pu, and their compounds. ***S. Lawroski.*** *Reactor Fuel Processing*, v. 2, no. 3, July 1959, 40 pp.

13368* Nuclear Auxiliary Power for Space Vehicle. Discusses three main problems of a space nuclear engine: radiator, energy conversion cycle, and materials. ***D. L. Cochran, et al.*** *SAE Journal*, v. 67, Aug. 1959, p. 64-67.

13369 Symposium on Radiation Effects on Materials. v. III. 1959. American Society for Testing Materials, Baltimore, Md. (TA410 Am35sre)

13370 Cross Sections for Neutron-Induced Reactions. A Review of Phenomenological Descriptions. Descriptive framework for treating nuclear reactions and current phenomenological models and methods for calculating nuclear cross sections are reviewed with particular reference to neutron-induced events at energies up to ~ 14 Mev. General scattering theory for two-body systems is developed. Resonance theory is described from an elementary point of view and results of the derivative-matrix formulation are discussed. ***David M. Chase, Carl N. Klahr, and Aaron Temkin.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-79, Feb. 1958, 132 pp. (TL507 Un3.18w Vis.)

13371 A Monte Carlo Code for Gamma Ray Transmission Through Laminated Slab Shields. IBM 704 code for computing the transmission of monoenergetic and monodirectional γ rays by a multilayered slab geometry shield is described. Main output data are the total energy current and flux. Associated energy spectra of each accompanied by their standard deviations are also obtained, but at lesser accuracy. ***Robert A. Liedtke and Herbert A. Steinberg.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-80, Apr. 1958, 133 pp. (TL507 Un3.18w Vis.)

13372 Dynamic Behavior of Boiling Reactors. Includes data on the following characteristics of the oscillations: power, pressure, temperature, reactivity amplitudes and their rate of change; thresholds, and harmonic content for BORAX I, II, III, IV, EBWR, LITR, VBWR, and SPERT I reactors. Results from three techniques of measuring the reactor transfer function are presented: the rod oscillation, the reactivity step, and the autocorrelation methods. ***J. A. Thie.*** *U. S. Atomic Energy Commission, ANL*-5849, May 1959, 51 pp. (UF767 Un3.1an Contin.)

13373 Ignition Behavior and Kinetics of Oxidation of the Reactor Metals, Uranium, Zirconium, Plutonium and Thorium, and Binary Alloys of Each. Effects of variables, such as surface preparation, metallurgical history, specific area (sample size), additives to the metal, and O content and presence of moisture in the oxidizing gas were determined. ***J. G. Schnizlein, et al.*** *U. S. Atomic Energy Commission, ANL*-5974, Apr. 1959, 207 pp. (UF767 Un3.1an Contin.)

13374 Liquid Metal Fuel Reactor Research and Development Program. *U. S. Atomic Energy Commission, BAW*-1104, June 1958, 91 pp. (UF767 Un3.1ba Contin.)

13375 Progress Relating to Civilian Applications During May, 1959. ***Russell W. Dayton and Clyde R. Tipton, Jr.*** *U. S. Atomic Energy Commission, BMI*-1346, June 1, 1959, 106 pp. (UF767 U3b Contin.)

13376 A Determination of the Absolute Neutron Fission Cross Section of U^{235}. Determined by measuring (σ_i/σ_f) at 5.3 Å and combining this with scattering, absorption, and relative fission cross section measurements. Two multiplate ionization chambers, one containing B^{10} and the other U^{235}, were constructed. After corrections for chamber efficiencies, residual differences between chambers, and incoherent scattering, a value for $(1 + \alpha) = 1.171 \pm 0.009$ at 5.3 Å was obtained where $\alpha = (\sigma_\alpha\gamma/\sigma_f)$. This letads to a value of 580 ± 7 barns as the absolute fission cross section at 0.0253 ev. ***George J. Safford and Edward Melkonian.*** *U. S. Atomic Energy Commission, CU-186,* May 1, 1959, 96 pp. (UF767 Un3.1cu Contin.)

13377 Fission Product Ruthenium Volatility in a High Temperature Process. Study of the behavior of fission product Ru during the calcination of an Al nitrate-nitric acid raffinate at 400 C. Degree of volatility of the Ru as well as the effect of nitrate pretreatment of aqueous feed, dilution of the nitrate content of the feed, and drastic reduction of the oxidizing power of the calciner atmosphere on the volatility, have been defined. ***C. E. May, B. J. Newby, K. L. Rohde, and B. D. Withers.*** *U. S. Atomic Energy Commission, IDO-14439,* July 1, 1958, 51 pp. (UF767 Un3.1id Contin.)

13378 Hydraulics of ETR-MTR Capsule Experiments. Supplement to IDO-16368. Results indicate that calculated flow rates through experiments in the ETR or MTR are usually about 15-30% different than measured flow rates. Capsule experiments are loaded into thin-walled Al tubes that are about three feet long. ***R. G. Beck.*** *U .S. Atomic Energy Commission, IDO-16516,* May 28, 1959, 43 pp. (UF767 Un3.1id Contin.)

13379 Spent Fuel Element Activity and Core Burnup Distribution From the MTR Plutonium Core Loading. Gamma decay dose-rate from the spent fuel elements was measured throughout the cooling period. Elements with a fuel burnup from 6.8 megawatt-days to 31 megawatt-days were scanned from 4 hours after reactor shutdown to 150 days. Comparison of activity from a typical Pu element and a standard MTR element. Core burnup distribution has been calculated using average and peak flux values in addition to the fission product activity from the elements in the core. ***J. M. Waage.*** *U. S. Atomic Energy Commission, IDO-16524,* June 12, 1959, 20 pp. (UF767 Un3.1id Contin.

13380 Reactor Power Transients as Calculated by the Space Independent Reactor Equations. Part of the ETR and MTR safety systems analysis. Calculations were performed on the IBM-650 digital computer located at the MTR site by numerically integrating the basic nonlinear space-independent reactor equations (with delayed neutrons). ***K. V. Moore and W. J. Byron.*** *U. S. Atomic Energy Commission, IDO-16534,* 20 pp. (UF767 Un3.1id Contin.)

13381 Core Power Variation and Fuel Burnup in the Engineering Test Reactor. Neutron flux measurements were made in the ETR before, during, and after the operation of two different cores. Measurements were used to calculate the % core power in each of the fuel assemblies and control rod fuel sections. Per cent values were in turn used to calculate the burnup of U-235. ***L. J. Harrison.*** *U. S. Atomic Energy Commission, IDO-16540,* July 8, 1959, 34 pp. (UF767 Un3.1id Contin.)

13382 Army Gas-Cooled Reactor System Program. Progress Report for May 1959. Includes a water-moderated heterogeneous reactor (Gas-Cooled Reactor Experiment I), a graphite-moderated homogeneous reactor (Gas-Cooled Reactor Experiment II), a mobile, gas-cooled reactor (ML-I) and the Gas Turbine Test Facility. *U. S. Atomic Energy Commission, IDO-28541,* June 29, 1959, 40 pp. (UF767 Un3.1id Contin.)

13383 Reactor Technology Report No. 9—Engineering. Developments in unclassified reactor technology in the area of engineering. *U. S. Atomic Energy Commission, KAPL-2000-6,* June 1959, 163 pp. (UF767 Un3.1ka Contin.)

13384 General Handbook for Radiation Monitoring. *Jerome E. Dummer, Jr., editor.* *U. S. Atomic Energy Commission, LA-1835,* (3rd Ed.) Nov. 1958, 180 pp. (UF767 U3La Contin.)

13385 Neutron Scattering by U^{235}, Pu^{239}, and U^{238}. Data on the angular distribution of elastic scattering and on the spectrum of inelastically scattered neutrons for incident neutrons of energies 0.55, 1, and 2 Mev, using a pulsed-beam time-of-flight method. Elastic scattering for U^{238} at 0.98 Mev is included. ***Lawrence Cranberg.*** *U. S. Atomic Energy Commission, LA-2177,* June 22, 1959, 53 pp. (UF767 U3La Contin.)

13386 A Survey of the Decomposition Rates of Organic Reactor Coolants. Rates determined as the result of operation of the OMRE are included in addition to the results of in-pile loop, gamma, and electron irradiations. Recommended values are presented. Coolant makeup rate and cost have been calculated for two designed organic reactor plants. ***R. H. J. Gercke and C. A. Trilling.*** *U. S. Atomic Energy Commission, NAA-SR-3835,* June 10, 1959, 26 pp. (UF767 Un3.1na Contin.)

13387 Progress Report. Pebble Bed Reactor Program, June 1, 1958—May 31, 1959. *U. S. Atomic Energy Commission, NYO-2373,* Sections individually paged. (UF767 U3ny Contin.)

13388 Operation of the Aircraft Reactor Experiment. Details are presented on a 221 hr. run made in Nov. 1954. ***W. B. Cottrell, H. E. Hungerford, J. K. Leslie, and J. L. Meem.*** *U. S. Atomic Energy Commission, ORNL-1845* (Del.), Sept. 6, 1955, 238 pp. (UF767 U3o Contin.)

13389 Project Aquarium: Laboratory and Field Corrosion Tests for the Geneva Conference Reactor. Laboratory tests were conducted in distilled water with source materials of 1100 Al. Field tests were run in demineralized cooling water at the Bulk Shielding Facility with dimensionally rejected Geneva elements. ***J. L. English, A. R. Olsen, and E. G. Bohlmann.*** *U. S. Atomic Energy Commission, ORNL-2716,* July 9, 1959, 59 pp. (UF767 U3o Contin.)

13390 Specifications and Fabrication Procedures on Europium-Bearing Absorber Rods for Reactivity Control in Core II of SM-1. *C. F. Leitten, Jr., R. J. Beaver, and J. E. Cunningham.* *U. S. Atomic Energy Commission, ORNL-2733,* July 29, 1959, 71 pp. (UF767 U3o Contin.)

13391 Lawrence Radiation Laboratory Counting Handbook. Includes sections on amplifiers, cables and coaxial components, coincidence systems and discriminators, oscilloscopes and monitoring, photomultipliers and scintillators, scalers and readout equipment, and waveform generators and analyzers. *U. S. Atomic Energy Commission, UCRL-3307* (Rev.), Jan. 1, 1959, 221 pp. (UF767 U3u Contin.)

13392 Complete Determination of Polarization for a High-Energy Deuteron Beam. Measurements have been made, by double scattering, of all parameters necessary to describe completely the interaction of the deuteron with complex nuclei. Deuterons of 410 and 420 Mev were scattered from Be and C, respectively. ***Janice Button.*** *U. S. Atomic Energy Commission, UCRL-8691,* May 4, 1959, 126 pp. (UF767 U3u Contin.)

13393 Spins, Moments, and Hyperfine Structures of Some Bromine Isotopes. Results were measured by the method of atomic beams. Describes experimental techniques, theory, and apparatus employed, together with a discussion of the results. ***Thomas Myer Green, III.*** *U. S. Atomic Energy Commission, UCRL-8730,* June 1959, 111 pp. (UF767 U3u Contin.)

13394 Positive-Pion Production by Negative Pions. A liquid H target was bombarded by negative pions of energies 260, 317, 371, and 427 Mev. Positive π mesons from the reaction $\pi^- + p \rightarrow \pi^+ + \pi^- + n$ were detected by using a counter telescope which selected the π^+ by its characteristic π-μ decay. ***Walton A. Perkins, III.*** *U. S. Atomic Energy Commission, UCRL-8778,* June 4, 1959, 60 pp. (UF767 U3u Contin.)

13395 Thermoelectric Nuclear Fuel Element Annual Progress Report. Discusses the preparation and thermoelectric properties of mixed valence materials. ***J. C. Danko, et al.*** *U. S. Atomic Energy Commission, WCAP-1162,* Apr. 15, 1959, 111 pp. (UF767 Un3.1wc Contin.)

13396 An Indirect-Cycle Nuclear-Reactor System to Furnish Process Heat—Engineering and Design Concepts. A conceptual design of a nuclear reactor to furnish process heat for coal gasification has been made. Pressures, temperatures, and heat duty for a projected commercial system to gasify 120,000 pounds of coal per hour have been calculated. ***R. Carson Dalzell and James P. McGee.*** *U. S. Bureau of Mines Information Circular* 7920, 1959, 16 pp. (TN21 Un3i Vis.)

13397* Temperature Distribution in Nuclear Reactors. Damage due to heat, proportional to the neutron flux, is avoided by proper cooling. Internal temperature of a fuel element can be computed from temperature of the coolant, if density of heat source is known. Fuel element must not be overloaded with increased enrichment of fuel towards edge of reactor, even temperature distribution can be obtained in its interior. (*In German.*) Die Temperaturverteilung in Kernreaktoren. ***Max Ritzi.*** *VDI Zeitschrift*, v. 101, no. 20, July 11, 1959, p. 825-831.

13398 Zero Gradient Synchrotron. Includes history of particle accelerators, construction details of Z. G. S., research to be carried out, and how particles are detected. 59 pp. 1959. Argonne National Laboratory, Chicago. (Pamphlet.)

See also: **12531** (shielding concrete); **12536** (graphite handbook); **12544** (UO_2 fuel materials); **12585** (separating Ba-140 from MTR fuel); **12706** (reactor coolants); **12847** (radiation effects in semiconductors); **12988** (gas turbine progress report); **13056** (strain measurements in intense radiation fields); **13185** (effects of neutron irradiation on Be); **13287** (transformations in U-fission alloys); **13289** (radiation induced phase transformation in U-Mo alloy); **13634** (welding of fuels and controls for Dresden Power Station).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

13399* Cost Analysis and Machine Replacement. Examination of various techniques for determining desirability of investing capital in proposed improvements. ***Robert A. Lowe.*** *Automation*, v. 6, Aug. 1959, p. 46-56.

13400 Automation and Society. The editors believe that automation is far more than a mere technological accomplishment—that it is, rather, an intellectual and social challenge, heavy with promise and with problems. Presents considered conclusions of some 32 experts who have examined present and potential impact of automation upon many facets of our society. ***Howard Boone Jacobson and Joseph S. Roucek, editors.*** 553 pp. 1959. Philosophical Library, New York. (HD45 J15a)

13401 Five-Year Plan for Saving Jobs. The president of Tremco Mfg. has given his executives room to expand; if they succeed, their jobs should be secure. *Business Week*, no. 1563, Aug. 15, 1959, p. 64 + 2 pages.

13402 Plant Managers Ponder Pitfalls of Practical Politics. Personal Products Corp's. program is part of a trend in which chemical process concerns are doing more to encourage management-level personnel to take an active part in state and local politics. *Chemical Week*, v. 85, no. 8, Aug. 22, 1959, p. 44-46.

13403* Getting Your Best Plant Layout. Several advantageous ways to lay out a given plant are shown in this article, as well as examples of poor layouts to be avoided. ***Richard Muther.*** *Factory*, v. 117, Aug. 1959, p. 68-73.

13404 What's Management's Obligation to Its Problem Employees? Management has definite limits to its obligation to problem employees. ***Robert N. McMurry.*** *Iron Age*, v. 184, no. 8, Aug. 20, 1959, p. 103-105.

13405* Better Work Standards Through Statistical Time Analysis. Quality Versus Quantity in Time Study. Describes graphic procedures by which statistical techniques can be applied to the analysis of time study data for more accurate determination of standard times for work measurement. ***Sidney Smith.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 261-265.

13406* An Application of Queueing Theory for Determining Manpower Requirements for an In-Line Assembly Inspection Department. ***Lawrence J. Seapaniak.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 265-267.

13407* The Organization of Controllership. Gives general requirements for an organization necessary to implement an advanced concept of controllership, within the framework of a centralized manufacturing structure. Attempt is made to indicate the dynamics of the Controller's office operation. ***E. B. Cochran.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 268-277.

13408* Least-Cost Testing Sequence. From the economic standpoint, the order of testing *is* usually significant. Thus, there will be one sequence of testing which will result in the least total cost of testing. ***H. Walter Price.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 278-279.

13409* The Application of Sample Survey Methodology to Work Sampling. Presents statistical methodology of work sampling applied on a larger scale than has generally been presented in the literature, and to a much larger and more complex set of activities. ***Albert Mindlin.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 286-295.

13410* Simulation As a Production Aid. In the case cited, simulation in no way furnished a yes or no answer to the manufacturing problem. When used as an additional tool along with the other tools of the engineer, it helped lead the study to a logical conclusion. ***John L. Colley, Jr.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 296-298.

13411* Inventorying for Unknown Demand. A persistent realization which attends the efforts of the engineer to approach managerial decisions analytically is that most techniques of analysis require more information than is available. Despite this fact, the principles suggested in this article have two important attributes. They make the decision process explicit so that it can be studied, reviewed, criticized, and improved. They also promote consistency through the use of such information as is available and the clarification of the guesswork that must be thrown in. Viewed in this light, the field of decision theory is not "far out", but extremely "practical". ***William T. Morris.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 299-302.

13412* Cyclic Servicing. Helps evaluate the cyclic procedure by presenting a formula for calculating the standard efficiency of a group of semi-automatic machines assigned to one operator who will service them on a cyclic pattern. Proof of the formula is given, followed by a demonstration of its use. ***Thomas F. O'Connor.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 303-307.

13413* Operations Research in Management Planning and Control. Illustrates how an operations research approach using modern scientific technology and electronic computation facilities can be applied to an operating situation. ***W. J. McGuire.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 308-312.

13414* The Design of a Force Platform for Work Measurement. One of the most recent and interesting techniques for evaluating work has been Lauru's "effort detector". It is contended that direct interpretations can be made from the recordings to indicate which is the one best way to do a task. This is an idea that requires considerably more research before being fully accepted, but the authors have made some interesting correlations between platform recordings and physiological costs. ***James H. Greene and W. H. M. Morris.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 312-317.

13415* The Independence of Pace Rating Versus Weight Handled. Research is concerned with an investigation of the rating phase of time study. ***C. B. Gambrell, Jr.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 318-322.

13416* Summary of the Industrial Engineering Symposium, the University of Iowa, November, 1958. ***Austin Weston and D. G. Malcolm.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 323-326.

13417* The Simulation of a Large-Scale Military Activity. Describes first experiment of the RAND Logistics Systems Laboratory, which was concerned with testing a series of logistics policies in a detailed man-machine simulation. ***Murray A. Geisler.*** *Management Science*, v. 5, no. 4, July 1959, p. 359-368.

13418* Rational Systems and Logics of Action: The Factory Situation. Rational models intersect in a fundamental way with the value logics of the people affected. The result is that restraints and restrictions arise; these must be taken into account in developing rational techniques for factory activity. Rational techniques, in essence, should supply a framework within which the value logics of the various groups involved can come to equilibrium. ***Adam Abruzzi.*** *Management Science*, v. 5, no. 4, July 1959, p. 369-386.

13419* Competitive Coefficients. The value relationships among competitors in a competitive situation are described by means of competitive coefficients. Competitive coefficient defines indirect gain or loss to a competitor as result of losses or gains by the other competitors. Example is given to illustrate the use of the coefficients in a game situation. ***Lawrence Friedman.*** *Management Science*, v. 5, no. 4, July 1959, p. 404-409.

13420* Production Lines and Internal Storage—A Review. Three basic approaches are discussed:—a. loss transfer (fractions of losses due to stoppage are transferred to succeeding stages) b. stochastic (distribution of durations of working and down states of each stage leading to determination of state probabilities) c. queue treating production lines or queue systems with limitations on size of queue between stages. ***Ernest Koenigsberg.*** *Management Science*, v. 5, no. 4, July 1959, p. 410-433.

13421* The Use of an Economic Lot Range in Scheduling Production. Since cost is relatively insensitive to the production quantity within some range of minimum cost production quantity, substantial freedom of action can be given the production scheduler provided he stays within some defined range; two approaches to defining such a range. ***Morris J. Solomon.*** *Management Science*, v. 5, no. 4, July 1959, p. 434-442.

13422* The Industrial Engineer as a Potential Executive. Industrial engineering, broadly conceived, is a built-in management development program in a company. This concept of industrial engineering allows the smaller company to attract men of real ability, will help reduce management-staff rift, and provides the necessary background for potential managers. ***M. E. Mundel.*** *Modern Castings*, v. 36, Aug. 1959, p. 83-85.

13423* Productivity and Human Relations. The first and most important principle in any plan for increased productivity is to insist that it be the joint product of employer and employee thinking. Organization is one of the principal factors determining the productivity of labor, and any improvement in managerial performance will cause a rise in productivity. ***Lawrence Shatkin.*** *Paint and Varnish Production*, v. 49, no. 9, Aug. 1959, p. 71-72.

13424 Management in the Year 2059. You'll be able to put on an electronic information cap and your development course will emphasize chiefly ability to think. ***Gilbert C. Jacobus.*** *Petroleum Engineer*, v. 31, Aug. 1959, p. A21-A23.

13425 Exploding Technology—Management's Most Urgent Problem. An industrialist warns executives that they cannot make decisions today without technological understanding. ***Willard F. Rockwell, Jr.*** *Petroleum Engineer*, v. 31, Aug. 1959, p. A34-A36.

13426 Why Do People Act That Way? Even to be moderately successful we must learn what motivates people and what to do about it. ***Robert W. Dorman.*** *Petroleum Engineer*, v. 31, Aug. 1959, p. E2 + 3 pages.

13427* Using Job Descriptions in Research Laboratories. ***I. Goldman.*** *Research Management*, v. 2, no. 1, Spring 1959, p. 45-52.

13428* Professional and Administrative Ladders: The Advantages of Broad Job Classification in a Research Organization. Two reasons are commonly put forth for "administrative ladders", namely, (1) they provide a status symbol for outstanding persons, and (2) they serve as a convenient mechanism for rewarding such people financially. This article concludes that professional "ladders" are not needed, not wanted, and are fraught with more disadvantages than benefits. ***Frank D. Leamer.*** *Research Management*, v. 2, no. 1, Spring 1959, p. 53-62.

13429 Research Techniques in Human Engineering. The aim of this book is twofold. Its first purpose is to describe some of the methods available to the human engineer for collecting trustworthy data on men and machines and the relationships between them. Its second purpose is to discuss some principles and guide lines about ways to doing dependable studies on people. ***Alphonse Chapanis.*** 316 pp. 1959. The John Hopkins Press, Baltimore. (T57 C36r)

13430* Fundamental Control Techniques. II. Control Charts. II. a. Discusses attribute charts which are concerned with classifying items as good or bad, or in counting and identifying defects without trying to measure any characteristics. ***Mason E. Wescott.*** *Rubber World*, v. 140, no. 5, Aug. 1959, p. 717-722.

13431* Upgrading the Engineer Into Technical Management. Here is a report on the approaches worked up by several leading aerospace companies. ***Robert M. Loebelson.*** *Space/Aeronautics*, v. 32, no. 2, Aug. 1959, p. 40-41.

13432 Wage Administration Plans, Practices, and Principles. Explains and analyzes the various tools—job analysis, job evaluation, wage survey, wage incentive, personnel rating, etc. ***Charles W. Brennan.*** 439 pp. 1959. Richard D. Irwin, Inc., Homewood, Illinois. (HD4909 B75w)

See also: **13142** (work-study techniques for foundries).

ORE AND MATERIALS BENEFICIATION

13433 Softening Temperatures of Iron Ores and Sinters. A study of incipient softening temperature of various ores and sinters (fluxed and unfluxed), and composition of the sixteen different ores and sinters studied. ***L. M. Tsylev.*** *Henry Brutcher Translation No.* 4609, 18 pp. (From *Izvestiya Akad. Nauk SSSR, Otd. Tekh. Nauk*, no. 6, June 1948, p. 889-898.) Henry Brutcher, Altadena, Calif.

13434 Rate Control in the Hydrometallurgical Preparation of Uranium Dioxide. Reduction takes place in two phases; first, as described by Forward and Halpern; second, much slower than the first, is associated with the complete covering of the catalyst by the solid product. ***D. R. Wiles.*** *Canadian Journal of Chemical Engineering*, v. 37, no. 4, Aug. 1959, p. 153-156.

13435 Recovery of Uranium Hexafluoride Vapors. Corrosive vent gases are passed through a fluidized bed of impure UF_4 where essentially all the UF_6 and part of the fluorine react to form uranium fluoride intermediates. ***J. L. Powell, W. R. Foreshee, and Seymour Bernstein.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 919-920.

13436* Differential Thermal Analysis for Ore Treatment Study. Process in some cases detect and estimate materials present in amounts of about 10%, with an accuracy of ± 1%. ***William I. Watson.*** *Mining Engineering*, v. 11, July 1959, p. 694-696.

13437* Thorium and Uranium Resources in Monazite Placers of the Western Piedmont, North and South Carolina. Data are mapped and tabulated for 44 basins. ***William C. Overstreet, Paul K. Theobald, Jr., and Jesse W. Whitlow.*** *Mining Engineering*, v. 11, July 1959, p. 709-714.

13438* Flocculation to Improve Coal Slurry Filtration. Shows that each slurry must be evaluated individually for possible benefits of flocculation to be predicted. ***M. R. Geer, P. S. Jacobsen, and H. F. Yancey.*** *Mining Engineering*, v. 11, July 1959, p. 715-719.

13439 Ferrograde Concentrates From Arkansas Manganiferous Limestone. ***M. M. Fine.*** *Mining Engineering*, v. 11, Aug. 1959, p. 810-812.

13440 The Effect of Sulfate on the Extraction of Uranium. Complete equilibrium distribution data have been determined by extractions from aqueous solutions containing 0.1 to 480 grams of U per liter, 0 to 96 grams of sulfate per liter, and 0 to 150 grams of salt nitrate per liter, which were 0 to 5.5 molar in nitric acid. ***M. O. Nethaway and G. P. Lang.*** *U. S. Atomic Energy Commission, MCW-1430*, July 1, 1959, p. III-25-III-27. (UF767 Un3.1mc Contin.)

13441 A Process for Controlling Insoluble Uranium in Ore Concentrates. III. Plant Operation. A Herreshoff furnace was successfully utilized to achieve a reduction in the nitric-acid-insoluble-uranium content of Vitro concentrate to a level of about 0.15% on a sample basis. ***W. S. Knecht and L. R. Hollrah.*** *U. S. Atomic Energy Commission, MCW-1432*, July 31, 1959, 31 pp. (UF767 Un3.1mc Contin.)

13442 Recovery of Thorium, Uranium, and Rare Earths From Monazite Sulfate Liquors by the Amine Extraction (Amex) Process. ***D. J. Crouse and K. B. Brown.*** *U. S. Atomic Energy Commission, ORNL-2720*, Aug. 3, 1959, 66 pp. (UF767 U3o Contin.)

13443 Solvent Extraction of Uranium From Reduction Slag Slurry. ***A. D. Ryon and F. L. Daley.*** *U. S. Atomic Energy Commission, ORNL-2744*, July 28, 1959, 22 pp. (UF767 U3o Contin.)

13444* **Iron Ore.** Some chemical analyses of Fe ores are given and import data of Fe ores are cited. (*In Polish.*) Rudy żelaza. ***Tadeusz Dankowski.*** *Wiadomosci Hutnicze*, v. 15, no. 6, June 1959, p. 195-198.

See also: **12584** (uranium beneficiation).

PHYSICS

13445 Speed of Sound in Distilled Water as a Function of Temperature and Pressure. An ultrasonic pulse type apparatus was used to measure the speed of sound in distilled water over the pressure range 14.7 to 14,000 psia and the temperature range 0.9 to 91.2 C. The temperature where the maximum sound speed occurs shifts to a higher temperature when the pressure is increased. At atmospheric pressure, the computed maximum speed was 1555.36 m/sec., and occurred at a temperature of 74.164 C. ***Wayne D. Wilson.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1067-1072.

13446 Resonance Absorption and Molecular Crystals. II. Benzene. Thermal oscillations in molecular solids are of two distinct classes: lattice vibrations and atomic vibrations within each molecule. These two vibrational modes can overlap in frequency and "resonate". This resonance leads to lengthy relaxation times manifested as unusually high acoustic absorption, a phenomenon termed resonance absorption. In order to study resonance absorption in solid benzene, a method was developed for growing single benzene crystals of average linear dimension, 10 cm. At the acoustical frequency 10 mc, absorption in single benzene crystals is found to be 0.24 cm^{-1}; at 6.4 mc the value is 0.09 cm^{-1}. This excessively high absorption (10^4 higher than in crystalline quartz) was quantitatively predicted from available molecular constants by a theory given previously. A partial list of compounds is given in which resonance absorption is predicted to be the dominant absorption mechanism. ***Leonard Liebermann.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1073-1075.

13447 Reflection and Refraction of Elastic Waves at the Interface of Two Moving Semi-Infinite Plane Media. ***J. Clifton Samuels.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1076-1079.

13448 Splashes as Sources of Sound in Liquids. The mechanisms of sound production by the splashes made by the gas-to-liquid entry objects are discussed. ***G. J. Franz.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1080-1096.

13449 Additivity of Different Types of Masking. Two experiments were carried out to determine how masking for frequencies either above or below one band of noise combine with the critical-band type masking produced by a second band of noise. The results of both experiments indicate that at moderately high levels the combination of critical-band masking with another type of masking results in a 6-db increase in masking. Discusses implications of this result. ***Robert C. Bilger.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1107-1109.

13450 Masking Patterns of Tones. Monaural masking patterns were obtained for pure tones spaced by octaves from 250 cps to 8000 cps at 20-100 db SL on three listeners in an attempt to provide extensive data assessing the relative importance of aural harmonics and cochlear spread of masking tone activity in the extension of masking to frequencies above the masking tone. ***Richard H. Ehmer.*** *Acoustical Society of America, Journal*, v. 31, Aug. 1959, p. 1115-1120.

13451* An Experiment on Nonadiabatic Passage in Nuclear Magnetic Resonance. Magnetic fields of various amplitudes directed at different angles were suddenly superimposed upon the magnetic field determining the initial direction of magnetization. The results obtained are a simple confirmation of the vector model of nonadiabatic passage. ***A. Z. Hrynkiewicz, T. Waluga, and G. Zapalski.*** *Acta Physica Polonica*, v. 17, no. 1, 1958, p. 71-75.

13452 Hard Magnetic Materials. Characteristics of metallic powder, iron oxides and related powder materials, and ferrites. ***E. P. Wohlfarth.*** *Advances in Physics*, v. 8, no. 30, Apr. 1959, p. 87-224 + 6 plates.

13453 Advances in Semi-Conductor Science. Proceedings of the Third International Conference on Semi-Conductors Held at the University of Rochester, August 18-22, 1958. ***H. Brooks, editor.*** Pergamon Press, New York. 1959, 553 pp. (QC611 In8.2a)

13454 Semiconducting Compounds. Recent Advances in the Optical and Electronic Properties of PbS, PbSe, PbTe and Their Alloys. The optical and electrical properties of PbS, PbSe, and PbTe are reviewed as they contribute to the understanding of the electronic band structure in these compounds. The optical absorption data generally favors a model in which the maximum of the valence band and the minimum of the conduction band occur at about the same value of the wave vector, k. Magnetoresistance data for these crystals are similar for *n*- and *p*-type crystals and the longitudinal magnetoresistance is generally larger (in some cases four or five times larger) than the transverse magnetoresistance at 77 and 4.2 K. The magnetoresistance data suggest that both band edges have the same structure and that constant energy surfaces are ellipsoids of revolution about the $<111>$ direction with centers away from k = O. A ratio of longitudinal to transverse effective mass of from 4-6 is thought to be most appropriate for PbTe. ***W. W. Scanlon.*** Paper from "Advances in Semi-Conductor Science. Proceedings of the Third International Conference on Semi-Conductors Held at the University of Rochester, U.S.A., August 18-22, 1958", Pergamon Press, New York. 1959, p. 423-428. (QC611 In8.2a)

13455* Status of Knowledge of the Fundamental Constants of Physics and Chemistry as of January 1959. A graphic record of past performance shows that the "best values" so obtained tend satisfactorily to stabilize within ever narrower error ranges which at each epoch are satisfactorily close to (usually in fact inside) the error ranges of prior adjustments. ***Jesse W. M. DuMond.*** *Annals of Physics*, v. 7, Aug. 1959, p. 365-403.

13456* On Weak Time-Symmetric Gravitational Waves. The existence and nature of the solutions of the initial value condition for the time-symmetric pure gravitational waves are investigated. Shows that corresponding to any nonsingular three-dimensional metric which is sufficiently close to the flat metric, there exists one and only one nonsingular solution of the initial value condition which is conformable to that metric; and the

energy of such gravitational waves is positive definite provided that the original metric is chosen sufficiently close to the flat metric. ***Huzihiro Araki.*** *Annals of Physics*, v. 7, Aug. 1959, p. 456-465.

13457* On the Positive Definite Mass of the Bondi-Weber-Wheeler Time-Symmetric Gravitational Waves. The energy is shown without approximation to be positive definite for every source-free, non-singular, time-symmetric, axially symmetric, asymptotically Schwarzschildian gravitational wave. Also, an explicit procedure is given to construct every such metric at the time of time-symmetry—a "still photograph" of a gravitational wave. ***Dieter R. Brill.*** *Annals of Physics*, v. 7, Aug. 1959, p. 466-483.

13458* Scattering of a Plane Monochromatic Wave by a System of Strips. Treated by means of separation of variables. New addition theorem for Mathieu functions is used to satisfy the boundary conditions on the strips. Approximate expression relating the transmission coeffiicent for the system of two slits to the transmission coeffiicent for a system of a single slit is given. ***K. Saermark.*** *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 7, no. 6, 1959, p. 417-440.

13459* Electron Spin Resonance and Thermoluminescence in Irradiated Fused Quartz. Irradiated with neutrons and protons at room tempearture and with X-rays and γ-rays at liquid air temperature. The two corpuscular radiations give rise to a narrow electron spin resonance line superimposed on a broader six-line structure. ***Olof Fröman, Rune Pettersson, and Tore Vänngård.*** *Arkiv för Fysik*, v. 15, no. 6, 1959, p. 559-566.

13460* Effect of Spectrometer Window on the *K* Absorption Edge of Au. ***Olof Beckman, Bertil Axelsson, and Pär Bergvall.*** *Arkiv för Fysik*, v. 15, no. 6, 1959, p. 567-578.

13461 A Photographic Study of Boiling in the Absence of Gravity. Equipment included a container for boiling water and a high-speed motion-picture camera. To eliminate the influence of gravity, these were mounted on a platform which was allowed to fall freely approximately 8 ft. ***R. Siegel and C. Usiskin.*** *ASME, Transactions, Series C, Journal of Heat Transfer*, v. 81, no. 3, Aug. 1959, p. 230-236.

13462* Radiative Transfer in Non-Uniform Media. A study is made of the emission from a simple model inhomogeneous semi-infinite medium, including the relative effects of variations across the surface. Particular attention is drawn to the significance of variations in attenuation coefficient in connection with the appearance of chromospheric granulation. ***R. G. Giovanelli.*** *Australian Journal of Physics*, v. 12, no. 2, June 1959, p. 164-170.

13463* The Structure of a Stream of Electrons and Ions Drifting and Diffusing in a Gas When Ionization by Collision and Molecular Attachment Are Present. A theory is developed. Cases considered include a point source and a line source, and in the latter case, the influence of a magnetic field is discussed. ***L. G. H. Huxley.*** *Australian Journal of Physics*, v. 12, no. 2, June 1959, p. 171-183.

13464 High Temp Transistors Draw Nearer. SRI grows small, pure crystals of Si carbides from molten Si in graphite crucible, now tries for larger ones. *Chemical and Engineering News*, v. 37, no. 33, Aug. 17, 1959, p. 34-35.

13465* Energetic Limits of Electroenforcement and Electroextinction Effects. Under the influence of electric fields the luminescent compounds of the type Cd ZnS; MnX have an increased sensitiveness (an X-ray excitation, an effect of electroenforcement) or a reduced sensitiveness (an excitation of ultraviolet rays, an effect of electroextinction). (*In French.*) Limite énergétique des effets d'électroenforcement et d'électroextinction. ***Georges Destriau.*** *Comptes Rendus Hebdomadaires des Seances de l'Académie des Sciences*, v. 249, no. 2, July 15, 1959, p. 245-247.

13466 Electromagnetic Phenomena in Cosmical Physics. Concentrates on magneto-hydrodynamics, solar electrodynamics, stellar magnetism, solar and interplanetary magnetic fields, and the electromagnetic state in interplanetary space. ***B. Lehnert, editor.*** 545 pp. 1958. Cambridge University Press, London. (QB461 L52e)

13467 Ferroelectric Crystals for Switching Applications. Characteristics indicate they may be used for information storage devices of small size and low power consumption as well as for transducers and phonograph pickups. ***M. Prutton.*** *Electronics*, v. 32, no. 33, Aug. 14, 1959, p. 58-59.

13468* A New Semiconductor for Temperature Measuring elements with large, linear, and highly reproducible a new family of semiconductors results—ideal temperature measuring elements with large, linear, and highly-reproducible resistance-temperature coefficients. ***John R. Pies.*** *ISA Journal*, v. 6, Aug. 1959, p. 50-54.

13469* Tomorrow's Light Is Here. Discussion of electroluminescent phosphors and their application to lighting panels. ***Henry F. Ivey.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 28 + 6 pages.

13470 Introduction to the Theory of Quantized Fields. A systematic presentation of the modern theory of quantized fields from its foundations right up to its most recent achievements. ***N. N. Bogoliubov and D. V. Shirkov.*** (Translated from the Russian by ***G. M. Volkoff.***) v. III, 1959, 720 pp. Interscience Publishers, New York. (QC174.5 B63vtr)

13471* The Transition of a Gas of Electrons Between Metallic and Isolating States. Application on Bands of Impurities and on Antiferromagnetics. I. In a solid, the Bloch approximation becomes invalid when the coulombic repulsion between electrons is not small as compared to the band width. Then a transition from the metallic to the insulating state may occur. Such a result is obtained by means of a transformation which leads to a segregation of the electrons of opposite spins on two sublattices. (*In French.*) Transition entre états métalliques et esolants pour un gaz d'electrons. Application aux bandes d'impuretés et aux antiferromagnétiques. I. ***Jacques Des Cloizeaux.*** *Journal de Physique et le Radium*, v. 20, no. 6, June 1959, p. 606-620.

13472 High-Energy Electron Irradiation of Germanium and Tellurium. Tellurium samples in which current flowed parallel to the *c* axis were irradiated at 78 K with 20-Mev electrons. The conductivity increased linearly with a slope of $1.0 \times 10^{-14}(\text{ohm-cm})^{-1}$ per electron/cm^2 up to at least 3×10^{14} electrons/cm^2. Beyond 3×10^{15} electrons/cm^2, the slope was approximately one tenth of the initial value. The reciprocal of the Hall coefficient decreased at first and then increased. Between 1×10^{13} and 5×10^{16} electrons/cm^2 $1/RH$ increases linearly from 3×10^{-5} to 6.3×10^{-5} coulomb/cm^3. After irradiation, the samples showed no measurable conductivity changes during 14 hr at 78 K. After a day's anneal at 300 K, the 78 K conductivity returned to its preirradiation value. *N*-type Ge was irradiated with 20-Mev electrons at room temperature. Conductivity measurements indicated that the sample became intrinsic and then *p* type. However, the detailed dependence of conductivity on radiation dosage did not agree with a calculation based on four energy levels introduced into the gap. Carrier lifetime changes were also observed. ***Victor A. J. van Lint and Harold Roth.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1235-1238.

13473 Radiation-Produced Energy Levels in Compound Semiconductors. The effects of high-energy radiation on the electrical properties of compound semiconductors are reviewed. Emphasis is placed on those effects which can be interpreted in terms of energy levels. The following compounds are discussed: InSb, InAs, GaSb, AlSb, GaAs, InP, CdTe, and SiC. The implications of bombardment-produced changes in carrier concentration on possible energy levels are considered. Of the compound semiconductors, only InSb, irradiated at 200 K with electrons, has been sufficiently studied to enable a determination of the positions of the energy levels and their rates of generation. The annealing behavior of both InSb and GaSb is complex. A possible interpretation of these annealing characteristics in terms of shifting energy levels is discussed. ***L. W. Aukerman.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1239-1243.

13474 Displacement Thresholds in Semiconductors. The work of Seitz, Kohn, Klontz, Loferski, and Rappaport, Vavilov, et al., and Brown and Augustyniak on Ge are discussed and compared. Measurements of thresholds in Si and InSb also are discussed briefly. ***J. J. Loferski and P. Rappaport.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1296-1299.

13475 Energy, Orientation, and Temperature Dependence of Defect Formation in Electron Irradiation of *n*-Type Germanium. ***W. L. Brown and W. M. Augustyniak.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1300-1309.

13476 Irradiation Damage in Germanium and Silicon Due to Electrons and Gamma Rays. The simple model for atomic displacements by electrons of Seitz and Koehler is used to calculate the total number of displaced atoms in Ge and Si due to electrons and gamma rays of energies up to 7 Mev. Calculations are compared with reported experiments in the literature. Electron damage at energies below 1 Mev requires the assumption of threshold energies less than 30 ev, while the higher energy electron damage data are fairly well explained by a 30-ev threshold. The measured gamma-ray cross sections for atomic displacements are an order of magnitude smaller than the calculated cross sections, even for a 30-ev threshold both for Si and Ge. ***Julius H. Cahn.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1310-1316.

13477 Infrared Absorption and Photoconductivity in Irradiated Silicon. The absorption near the intrinsic edge is increased and drops off more gradually toward longer wavelengths. Several absorption bands are introduced by neutron irradiation with peak absorptions at 1.8, 3.3, 3.9, 5.5, and 6.0 μ, respectively. The observation of each band depends upon the position of the Fermi level. ***H. Y. Fan and A. K. Ramdas.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1127-1134.

13478 Mechanism and Defect Responsible for Edge Emission in CdS. The nature of the green and blue emission at 78 K in CdS has been investigated. On the basis of the wavelengths of absorption and emission lines, the blue component is assigned as exciton decay. ***R. J. Collins.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1135-1140.

13479 Diffusion-Controlled Reactions in Solids. Gives experimental examples drawn from the chemical physics of semiconductors, e.g., annealing of radiation damage, ion pairing, precipitation, and the formation of complexes in solids. ***Howard Reiss.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1141-1152.

13480 Magnetic Susceptibility of Solids. The magnetic susceptibility of semiconductors depends on electronic properties of the lattice, on the motion of free carriers and on the presence of impurity states. Critical points in the work on Ge and Si are reviewed relative to demands they place on theoretical interpretations. Anomalies in the susceptibility of high-purity specimens, various aspects of valence band carrier susceptibility, and the susceptibility of acceptor states are not as yet explained satisfactorily. ***J. A. Krumhansl.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1183-1186.

13481 Paramagnetic Resonance in Electron Irradiated Silicon. Electron spin resonance has been observed in *n*-type Si irradiated with 0.5-Mev electrons. Hyperfine structure due to interactions with Si^{29} nuclei is also observed. The hyperfine structure tensor exhibits a [111] symmetry indicating that the electron is not centered on the Si nucleus with which it is interacting. A model is suggested, consistent with the observed symmetries, according to which vacancies produced during irradiation diffuse to the distorted regions around O atoms. ***G. Bemski.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1195-1198.

13482 Energy Levels in Irradiated Germanium. The energy levels found in Ge irradiated by different particles seem at first to be mutually inconsistent. It is possible tentatively to reconcile the differences by consideration of clustering and association of defects. Four levels are ascribed to single vacancies and interstitials. A crude theory is constructed to explain these levels, particularly their asymmetrical distribution in the energy gap, and to assign each to a definite defect. This theory differs somewhat from a previous one due to James and Lark-Horovitz; some differences in experimental predictions are discussed in particular. ***E. I. Blount.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1218-1221.

13483 Radiation-Induced Energy Levels in Silicon. The energy level pattern is essentially independent of the damaging agent; the pattern seems to present a remarkable symmetry with respect to the middle of the gap; shallow levels close to the band edges are introduced in similar concentrations and at higher rates than the deep traps. ***Claude A. Klein.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1222-1231.

13484 Electron-Bombardment Damage in Oxygen-Free Silicon. Electron-bombardment damage in O-free Si is compared with that found in pulled crystals which have been previously reported. It is found, in agreement with conclusions drawn from spin resonance experiments, that the level 0.16 ev below the conduction band is associated with O. In O-free Si a deep level, 0.38 ev below the conduction band, is produced in dominant density, and a broad shallow level in lesser concentration. ***G. K. Wertheim and D. N. E. Buchanan.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1232-1234.

13485 Annealing of Radiation Defects in Semiconductors. Radiation induced defects studied through changes in conductivity and Hall coefficient have been observed to anneal in a number of different temperature ranges. Only those processes occurring above 80 K and involving defects created by electron irradiation have been considered in this paper. It has been found that the first annealing process in *n*-type Ge occurs at about 50 C and is structure sensitive, apparently to the original chemical donor impurity. ***W. L. Brown, W. M. Augustnyiak, and T. R. Waite.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1258-1268.

13486 Low-Temperature Annealing Studies in Ge. Irradiation at $\sim$ 10 K, using 1.10 Mev electrons, produces very different changes in the electrical properties of *n*-type Ge as compared with those produced in *p*-type Ge, more carriers are removed per incident electron at 10 K than at 78 K. However, about 50% of the removed carriers are recovered in two stages of annealing, at 34 K and 64 K, after low-temperture irradiation. ***J. W. MacKay and E. E. Klontz.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1269-1274.

13487 Ultrasonic Methods and Radiation Effects in Solids. The various mechanisms producing damping of ultrasonic elastic waves in solids are reviewed in this paper. Particular attention is given to the changes in attenuation produced by pinning of dislocation lines. Measurements of ultrasonic attenuation in irradiated single crystals of NaCl are presented and discussed, on the assumption that the dislocation density remains constant while the radiation displaced defects pin the dislocations. The effects on the velocity of propagation are discussed on the basis of the same model. ***Rohn Truell.*** *Journal of Applied Physics*, v. 30, Aug. 1959, p. 1275-1278.

13488* High-Frequency Ultrasonics. *Machinery Lloyd (Overseas Ed.)*, v. 31, no. 14, July 4, 1959, p. 81.

13489* Emission Electronic Microscope. Application on Investigation of Emission of Secondary Electrons by the Action of a Beam of Ions. II. Secondary Emission of a Target Bombarded With Ions. Chapter VI. Secondary Emission Caused by Rapid Ions. (*In French.*) Le microscope électronique par émission. Application à l'étude de l'émission d'électrons secondaires sous l'action d'un faisceau d'ions. II. Emission secondaire d'une cible bombardée par des ions. Chapter VI. Emission secondaire provoquée par des ions rapides. ***René Simon.*** *Métaux Corrosion-Industries*, v. 34, May 1959, p. 204-219.

13490 Detection of Nuclear Explosions in Space Possible by Optical Means. Two spectroscopes mounted in satellite proposed as method of surveillance. ***Savo Corić.*** *Missiles and Rockets*, v. 5, no. 32, Aug. 3, 1959, p. 32-33.

13491* Compensations in Electron Excitation Effects in *p-p* and *p-n* Scattering. ***M. deWit, C. R. Fischer, and W. Zickendraht.*** *National Academy of Sciences, Proceedings*, v. 45, July 1959, p. 1047-1052.

13492* A Survey of Our Present Sources of Information on the Conversion Constant, $\Lambda(=\lambda_s/\lambda_e)$ and the Absolute Wavelengths of X-Ray Emission Lines. ***Jesse W. M. Du-***

Mond. National Academy of Sciences, Proceedings, v. 45, July 1959, p. 1052-1080.

13493* Stabilization Process of the Suspension Layer of a Polydispersed System. The stabilization process was described by means of an equation. Single characteristics of unsteady and steady states of the suspension layer were obtained. The periods of stabilization of the separate fractions were identical. (*In Russian.*) Protsess stabilizatsii vzveshennogo sloia polidispersnoĭ sistemy. ***H. H. Shipkov and A. V. Gavrilin.*** *Nauchnye Doklady Vysshei Shkoly, Energetika*, 1959, no. 1, p. 103-108.

13494 A New Method in the Theory of Superconductivity. Discusses: Fröhlich's model of superconductivity, renormalized theory of superconductivity in Fröhlich's model spectrum of collective excitations in the superconducting state, inclusions of the Coulomb interaction between electrons, qualitative description of effects due to the Coulomb interaction and Fermi systems with weak interaction. ***N. N. Bogoliubov, V. V. Tolmachev, and D. V. Shirkov.*** (Translated from the Russian.) 121 pp. 1959, Consultants Bureau, Inc., New York. (QC611 B63ntr)

13495 Single-Particle Energies in a Degenerate Electron Gas at High Density. Expressions for the self-energy of an electron and the physical pair-propagator for an excited electron plus hole in a degenerate electron gas at high density are obtained through the formulation of an equivalent Hamiltonian for the problem. These expressions are identical to those obtained by Quinn and Ferrell. A derivation of the physical pair-propagator from ground state considerations is also given. ***Ronald M. Rockmore.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 941-945.

13496 Dependence of Electron Mobility on Magnetic Field in a Fully Ionized Gas. The variation of drift and Hall mobilities of electrons in a fully ionized gas with magnetic field has been investigated. ***M. S. Sodka and Y. P. Varshni.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 946-947.

13497 Ergodic Foundation of Quantum Statistical Mechanics. Relations, which are ergodic in a generalized sense, are deduced from laws of quantum theory without any hypothesis of *a priori* probabilities. These relations are satisfied for the overwhelming majority of the initial state-vectors of any isolated system with very many degrees of freedom. ***P. Bocchieri and A. Loinger.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 948-951.

13498 Thermoluminescence and *F*-Centers. I. Theory. II. Experimental. After a critical review of the present state of knowledge about thermoluminescence, which is shown to be rather unsatisfactory, thermoluminescence arising from thermal bleaching of *F*-centers in irradiated alkali halides is considered. A model is proposed, which leads to second-order kinetics for the radiative recombination of *F*-centers and Luminophor-centers (L_1) which must be present in the crystal lattice. ***G. Bonfiglioli, P. Brovetto, and C. Cortese.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 951-960.

13499 Deuteron Magnetic Resonance Spectrum and Relaxation in KD_2PO_4. The electric field gradient (EFG) tensor at the site of the deuteron in the H bond of KD_2PO_4 and the relaxation times of the deuteron have been studied. The measured quadrupole coupling constant is 119 kc/sec, the asymmetry parameter is 0.049, and the major principal axis of the tensor is along the bond direction. None of these features of the EFG tensor change appreciably with temperature over the entire range studied, which range includes the ferroelectric Curie point T_c. ***John L. Byorkstam and Edwin A. Uehling.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 961-968.

13500 Scattering of Phonons by Elastic Strain Fields and the Thermal Resistance of Dislocations. The Fourier component of the strain field plays a role similar to that of the potential in the external field approximation. All quantities (except the strain field) in the formulas obtained refer to specifically atomic characteristics, allowing in principle the examination of the influence or crystal structure, interatomic potentials, etc., and also scattering between different polarization modes. ***Peter Carruthers.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 995-1001.

13501 Spectral Diffusion, Phonons, and Paramagnetic Spin-Lattice Relaxation. Discusses the question of paramagnetic relaxation at low temperatures and the "phonon bottleneck" in terms of the analogy with Holstein's theory of trapping of resonance radiation in gases. Observes that the diffusion of phonon energy to the wings of the line is the limiting process, and a new mechanism for this in dilute cases is proposed. Since this mechanism involves the spin-spin interactions as well as phonons, it provides a reason for the observed increase of relaxation rate with concentration. ***P. W. Anderson.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1002-1005.

13502 Crystal Structure of Helium Isotopes. The neutron diffraction data of Henshaw for crystalline He4 have been treated by the method of least squares to obtain revised values of the lattice constants and their standard errors. The values so obtained, together with the pressure-volume-temperature data of Dugdale and Simon, are used to make a direct comparison with the interatomic distances and molar volume for β-He3, which is also hexagonal close-packed. ***Jerry Donohue.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1009.

13503 Slow-Electron Scattering by Atomic Oxygen. The collision cross section of slow electrons in atomic O has been deduced from simultaneous measurements of the dc conductivity and the microwave absorption coefficient of a predominantly atomic O gas mixture in a shock tube. Results showed that the Maxwell-averaged cross section attributable to atomic O must be about 1.5×10^{-16} cm^2 at an electron temperature of 4000 K (mean thermal energy $\sim$ 0.5 ev). Elaborating on the theoretical method of Klein and Brueckner, we find that this value is not inconsistent with the photodetachment cross section of negative O ions measured by Branscomb and coworkers. ***S. C. Lin and B. Kivel.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1026-1027.

13504 Low-Field Mobilities of the Negative Ions in Oxygen, Sulfur Hexafluoride, Sulfur Dioxide, and Hydrogen Chloride. The results are 2.46, 0.57, 0.35, and 0.71 cm^2/v-sec, respectively, reduced to 0 C and 760 mm. Hg pressure. A quantum-mechanical theory of ionic mobility is outlined and applied to the gases investigated experimentally. Comparison of the experimental and theoretical results indicates that the O ion is O_2-, but attempts to identify the ions in the other gases are inconclusive. ***E. W. McDaniel and M. R. C. McDowell.*** *Physical Review*, v. 114, 2nd ser., no. 4, May 15, 1959, p. 1028-1037.

13505* Observation of Nuclear Resonance in a Ferromagnet. Detected at room temperature in a sample of finely divided face-centered-cubic Co (Co^{59}) metal. Resonance frequency was measured to be 213.1 Mc/sec in zero applied field. This indicates a magnetic field of 213,400 oersteds at the site of the Co nuclei. ***A. C. Gossard and A. M. Portis.*** *Physical Review Letters*, v. 3, no. 4, Aug. 15, 1959, p. 164-166.

13506* Search for Leptonic Decays of the Sigma. Carried out by studying the (lab) momentum distribution of the Σ-decay products. The vast majority of the events lies within the region $\sim$ 160 to 224 Mev/c—the kinematic limits of the normal Σ-decay modes, $\pi \pm + n$. ***Jack Leitner, et al.*** *Physical Review Letters*, v. 3, no. 4, Aug. 15, 1959, p. 186-188.

13507* Proton Magnetic Resonance in Hydrates of Halogen Compounds of Mg, Ca, Sr and Ba. Studied in temperature range from -90 C to $+110$ C in powdered states. Transitions of second moment and line shapes were observed for all the above salts. ***Syukuro Yano.*** *Physical Society of Japan, Journal*, v. 14, July 1959, p. 942-954.

13508* On the Space-Time Formulation of Non-Relativistic Quantum Mechanics. ***Izuru Fujiwara.*** *Progress of Theoretical Physics*, v. 21, no. 6, June 1959, p. 902-918.

13509 Cryostat for Ferrimagnetic Resonance Experiments. The inner Dewar narrows to a fine tip containing the sample at its lower extremity where it protrudes through the outer vessel, and extends into a microwave cavity. ***J. F. Dillon, Jr., S. Geschwind, V. Jaccarino, and A. Machalett.*** *Review of Scientific Instruments*, v. 30, July 1959, p. 559-561.

13510* Experimental Studies of the Multiple Diffusion of Light. Laboratory measurements have been carried out of the luminance of scattered light in polyvinyl chloride and acetate

suspensions. Luminance curves are given for various optical densities of the scattering layers and for various illuminating directions. (*In French.*) Étude expérimentale des diffusions multiples de la lumière. ***Suzanne Isacchi and Jacqueline Lenoble.*** *Revue d'Optique Théorique et Instrumentale*, v. 38, no. 5, May 1959, p. 217-237.

13511 Some Relativistic Two-Body Kinematics Tables. Originally calculated for use in the design and analysis of experiments at the Cosmotron. They were produced by the IBM-704 at the AEC Computing Center of New York University. ***L. B. Leipuner.*** *U. S. Atomic Energy Commission, BNL* 513(T-125), Aug. 1958, 308 pp. (UF767 Un3.1bn Contin.)

13512 Table for Converting Photon Wavelength to Photon Energy in Electron Volts. Covers the range from 0.050 to 9.99 microns in increments of 0.001 from 0.050 to 0.999 microns and in increments of 0.01 from 1.00 to 9.99 microns. *U. S. Atomic Energy Commission, BNL* 553(T-146), May 1959, 6 pp. (UF767 Un3.1bn Contin.)

13513 Duration of Atomic Collisions: A Note on Recombination Rate Theory. A mechanical treatment of atomic recombination reactions is developed for the case in which the reaction is considered to involve an intermediate excited molecule which is stabilized on collision with any third body. An explicit rate calculation is given for the reaction $I + I + A \rightarrow I_2 + A$. ***Don L. Bunker.*** *U. S. Atomic Energy Commission, LA*-2295, July 2, 1959, 24 pp. (UF767 U3La Contin.)

13514 Quarterly Status Report of the Lasl Plasma Thermocouple Development Program for Period Ending June 20, 1959. ***Samuel Glasstone, editor.*** *U. S. Atomic Energy Commission, LAMS*-2333, July 1959, 14 pp. (UF767 Un3.1La Contin.)

13515 Relativistic Hydrodynamics. ***A. H. Taub.*** *U. S. Atomic Energy Commission, SCR*-67, Mar. 1959, 20 pp. (UF767 Un3.1scr Contin.)

13516 Some Microwave Studies of Gaseous Plasmas. The plasma is deviated slightly from its initially isothermal state and the various ways by which it returns to this isothermal state are studied. ***L. Goldstein.*** *U. S. Atomic Energy Commission, SCR*-104, July 1959, 33 pp. (UF767 Un3.1scr Contin.)

See also: **12524** (properties of $BaTiO_3$); **12525** (piezo properties of BaSr titanates); **12534** (preparation of piezoelectric crystals); **12542** (properties of TiO_2); **12543** (piezoelectric ceramics).

PLASTICS

13517 Failure Mechanisms in Glass Fiber Reinforced Plastics. In glass fiber reinforced plastic laminates, internal cracking under tensile stressing takes place because of yarn crimp. The cracking can be prevented by use of no-crimp fabrics, if loaded in a principal direction, or by using more ductile resins. ***M. B. Desai and F. J. McGarry.*** *ASTM Bulletin*, no. 239, July 1959, p. 76-79.

13518* On the Initiation Mechanism of Cationic Polymerization in the Presence of Halides. Results obtained on the kinetics of separate- and copolymerization of different monomers indicate that cationic polymerization in halidealkyl solvents can proceed directly under the effect of aprotonic acids without the participation of compounds with a specific function of catalyst. (*In Russian.*) K voprosu o mekhanizme initsiirovaniia kationnoĭ polimerizatsii v prisutstvii galogenidov metallov. ***A. R. Gantmakher, S. S. Medvedev, and E. B. Liudvig.*** *Akademiia Nauk SSSR, Doklady*, v. 127, no. 1, July-Aug. 1959, p. 100-103.

13519* Polymerization of Hexafluoro-1,3-Butadiene. It was found that diethylperoxide dicarbonate is the most effective initiator of the polymerization of hexafluoro-1,3-butadiene. The dependence of the velocity of polymerization on the nature of the initiator, temperature, and pressure was shown. The thermomechanical properties of the obtained polymers were determined. (*In Russian.*) Polimerizatsiia Geksaftor-1,3,-Butadiene. ***V. V. Korshak, A. M. Polyakova and M. D. Suchkova.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1959, no. 6, June, p. 1111-1115.

13520 Addition Polymerization of Anhydrosugar Derivatives. I. A Polyanhydroglucose. Conditions for the polymerization of levoglucosan to high molecular weight branched polysaccharides are described. Periodate oxidations of the products can be interpreted by assuming a repeating sequence of twenty anhydroglucose units of which eleven are unsubstituted on C_2, C_3, and C_4, seven are unsubstituted on C_2 and C_3 or C_3 and C_4, and two are resistant to periodate oxidation. Molecular weights were determined on fractionated and unfractionated samples by light scattering and are commonly from 20-50,000 and as much as 300,000 in the extreme. The monomer functionality and mechanism of polymerization are discussed and the products compared with other synthetic polysaccharides. ***José Da Silva Carvalho, Willem Prins, and Conrad Schuerch.*** *American Chemical Society, Journal*, v. 81, Aug. 5, 1959, p. 4054-4058.

13521 Machining Teflon to ±0.0005 in. Use of properties such as softness, poor thermal conductivity, variable stress relaxation, and cold flow help in cutting Teflon to close-tolerances. *American Machinist*, v. 103, Aug. 24, 1959, p. 106-108.

13522* The Mechanical Behavior of Swollen Polystyrene, Poly-*p*-chlorostyrene and Their Copolymers in Benzene. I. The Degree of Polymer-Solvent Interaction and Thermoelastic Properties. ***Kazuyoshi Ogino.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 6, June 1959, p. 553-556.

13523* The Fundamental Properties of Plastics. The basic science of polymers is interpreted for the design engineer in terms of molecular, chemical, and electron mechanisms and their effect on functional applications of plastics. ***Thomas D. Callinan and Alex E. Javitz.*** *Electrical Manufacturing*, v. 64, Aug. 1959, p. 105-120.

13524* On the Anionic Polymerisation of Lactams. II. Grignard Compounds as Catalysts of the Rapid Polymerisation of Caprolactam. (*In German.*) Über die anionische Polymerisation von Lactamen. II. Grignard-Verbindungen, als Katalysatoren der Schnellpolymerisation von Caprolactam. ***Siegfried Schaaf.*** *Faserforschung und Textiltechnik*, v. 10, June 1959, p. 257-260.

13525 Influence of Acids and Bases on Preparation of Urethane Polymers. Making the reaction mixtures acidic favors of a more linear product. ***H. L. Heiss, F. P. Combs, P. G. Gemeinhardt, J. H. Saunders, and E. E. Hardy.*** *Industrial and Engineering Chemistry*, v. 51, Aug. 1959, p. 929-934.

73526 The Polymerisation of Acetylene Derivatives. II. Polymerisation of Pentenynyl, Hexenynyl and Pentadienyl Esters of Dibasic Acids. Dipent-4-en-2-yn-1-yl phthalate readily undergoes polymerization in the crude state but suffers from thermal instability on distillation even in high vacuum. The corresponding ester of adipic acid showed, however, the increased stability anticipated on further separation of the vinylacetylenic groupings and yielded a tough, insoluble, difficultly-fusible polymer on heating with diazoaminobenzene as initiator. ***A. C. Davis and R. F. Hunter.*** *Journal of Applied Chemistry*, v. 9, pt. 7, July 1959, p. 364-368.

13527 Syntheses of Metal Complexing Polymers. IV. Polymers Containing Miscellaneous Functional Groups. A number of metal-complexing polymers with 8-hydroxyquinoline, kojic acid, *o*-hydroxyphenylarsonic acid, and salicylic acid functionality were synthesized. Preliminary experiments demonstrated appreciable metal-complexing properties. ***R. V. Davies, J. Kennedy, E. S. Lane, and J. L. Willons.*** *Journal of Applied Chemistry*, v. 9, pt. 7, July 1959, p. 368-371.

13528* γ-Irradiation of Styrene Copolymers. Styrene-methyl methacrylate and styrene-methyl acrylate copolymers were γ-irradiated in vacuo, and, in addition to viscosities, the decomposition gases were examined. ***W. Burlant, D. Green, and C. Taylor.*** *Journal of Applied Polymer Science*, v. 1, no. 3, May-June 1959, p. 296-299.

13529* The Stability of Fluorine-Containing Polymers to Amines. A number of fluorine-containing polymers and copolymers have been heated in the presence of *n*-butyl amine and large differences in reactivity have been observed. ***M. I. Bro.*** *Journal of Applied Polymer Science*, v. 1, no. 3, May-June 1959, p. 310-312.

13530 Effect of Associated Salts and Amines on Polymerization of Butadiene by Amylsodium. Triethyl amine and NaOH caused amylsodium to polymerize butadiene in a 1,4- rather than the usual 1,2- manner. The combination resembles in some aspects the alfin group of reagents but is less satisfactory with respect to the yield, size of polymer, and freedom from gel of the polybutadiene. The conditions under which this combination operates are described. ***Avery A. Morton and Frank K. Ward.*** *Journal of Organic Chemistry*, v. 24, July 1959, p. 929-934.

13531* A Novel Catalytic Polymerization of Olefins. I. Metal-Metal Halide Catalysts for High Polymerization of Lower Olefins. II. High Polymerization of Ethylene by Al-$TiCl_4$ Catalyst. ***Kenichi Fukui, et al.*** *Journal of Polymer Science*, v. 37, June 1959, p. 341-362.

13532* The Polymerization of Diallyl Phthalate, an Investigation by Infrared Spectroscopy. The changes in relative unsaturation of the monomer-polymer system of diallyl phthalate have been studied by means of the infrared absorption band at 1645 $cm.^{-1}$ over the temperature range of 60-120 C, both before and after gelation. ***Robert A. Spurr, Betty M. Hanking, and John W. Rowen.*** *Journal of Polymer Science*, v. 37, June 1959, p. 431-440.

13533* The Polymerization of Allylidene Diacetate. ***Donald R. J. Hill and Leslie Valentine.*** *Journal of Polymer Science*, v. 37, June 1959, p. 455-468.

13534* Effect of Chemical Structure on the Softening Point of Substituted Polystyrenes and Related Materials. The concept of a limiting softening point, defined in relation to a particular standard test method (B. S. 1493) but otherwise only a function of the repeat unit structure of the polymer, is discussed. An approximate correlation of results obtained from different standard methods is given and its limitations analyzed. Limiting softening point data are given for polystyrene and 25 different substituted polystyrenes. ***W. G. Barb.*** *Journal of Polymer Science*, v. 37, June 1959, p. 515-532.

13535 Investigation of Hardened Polyester Resins. II. Infrared-Spectroscopic Investigations of Decomposition Products of Hardened Polyster Resins. Cured polyester resins from unsaturated polyesters and styrene were degraded by solvolytic reactions. Degradation products were examined by infrared spectroscopy. (*In German.*) Untersuchungen über gehärtete Polyesterharze. II. U. R.- spektroskopische Untersuchungen an Abbauprodukten gehärteter Polyesterharze. ***Heinz Gilch, Werner Funke, and Karl Hamann.*** *Makromolekulare Chemie*, v. 31, nos. 2/3, June 1959, p. 93-111.

13536 Catalytic Reactivity of Organometallic Compounds for Olefin Polymerization. III. Vinyl Polymerization by Organoboron Compounds. ***Junji Furukawa, Teiji Tsuruta, Takanobu Imada, and Hideo Fukutani.*** *Makromolekulare Chemie*, v. 31, nos. 2/3, June 1959, p. 122-139.

13537 Interpolymer Ion-Selective Membranes. V. Polyvinylimidazole and Cross-Linked Polyvinylimidazolium-Dynel Membranes. ***Ph. Teyssié and H. P. Gregor.*** *Makromolekulare Chemie*, v. 31, nos. 2/3, June 1959, p. 192-196.

13538 Synthesis of Polyanhydrides. II. New Aromatic Polyanhydrides With High Melting Points and Fiber-Forming Properties. ***Naoya Yoda.*** *Makromolekulare Chemie*, v. 32, no. 1, July 1959, p. 1-12.

13539 Effects of Esters, Aldehydes and Some Impurities on the Polymerization of Vinyl Acetate. ***M. Matsumoto, et al.*** *Makromolekulare Chemie*, v. 32, no. 1, July 1959, p. 13-36.

13540 A Study of Two Bromine-Containing Peroxides as Initiators for the Radical Polymerization of Styrene. Styrene at various concentrations in benzene has been polymerized at 60 and 80 C using bis(3,5- dibromo-4-methoxybenzoyl) peroxide and bis(m-bromobenzoyl) peroxide as initiators. ***J. C. Bevington, J. Toole, and L. Trossarelli.*** *Makromolekulare Chemie*, v. 32, no. 1, July 1959, p. 57-65.

13541 3 New Cost Cutters. Spectacular premium-priced thermoplastics replace expensive metals and other design materials because they match their properties but are lighter in weight and need no finishing. *Modern Plastics*, v. 36, no. 12, Aug. 1959, p. 67 + 6 pages.

13542 Injection Molding FEP-Fluorocarbon Resin. Rheological properties of this resin determine the required molding conditions. ***H. A. Larsen, G. R. DeHoff, and N. W. Todd.*** *Modern Plastics*, v. 36, no. 12, Aug. 1959, p. 89 + 4 pages.

13543 How to Make Roll-Chilled Polyolefin Films Commercially. Leading producer of roll-chilled film tells how it is done and gives the conclusions he's reached in over a year's experience with the process. ***Fred J. Meyer.*** *Modern Plastics*, v. 36, no. 12, Aug. 1959, p. 97 + 5 pages.

13544 Gas Transmission by Plastics Films. Apparatus that provides simplicity, sensitivity, speed, flexibility, and automation is described for the determination of rate of gas transmission by plastics films. ***W. E. Brown and W. J. Sauber.*** *Modern Plastics*, v. 36, no. 12, Aug. 1959, p. 107 + 6 pages.

13545* Oriented Polystyrene Sheet. I. Properties and Applications. Dimensional stability, mechanical characteristics, permeability, and a number of applications. ***Merlin L. Evans.*** *Package Engineering*, v. 4, Aug. 1959, p. 40-43.

13546 Phenolic Resins. A concise presentation of raw materials, production methods, and applications of phenolic resins. Emphasizes practical features, including commercial and economic considerations. Gives information on use of phenolics in combination with other resins. ***David F. Gould.*** 213 pp. 1959. Reinhold Publishing Corporation, New York. (TP986.P4 G73p)

13547* Polyisocyanurates—A New Type of Film Material From Diisocyanates. I. The conversion of dicarboxylic diamides by toluylenediisocyanate into a polyureide-like substance, and its further conversion by toluylene-diisocyanate, in the presence of a catalytic solvent, into a new film material containing polyisocyanurates is described. (*In German.*) Polyisozyanurate—Neuartiges Filmmaterial aus Diisozyanaten. ***K. Thinius and G. V. Hintzenstern.*** *Plaste und Kautschuk*, v. 6, June 1959, p. 275-278.

13548* Studying Extrusion Flow Lines. New techniques and results obtained on flow paths followed by molten material during extrusion. ***L. F. Street.*** *Plastics Technology*, v. 8, Aug. 1959, p. 27-31.

13549* Effects of Stress Concentrations on Laminate Strength. Results of a comprehensive study on glass fiber-reinforced polyester laminates. ***E. L. Strauss.*** *Plastics Technology*, v. 8, Aug. 1959, p. 35-39.

13550 Three New Epoxies Join the Pre-Preg Laminates. Recently developed resin series combines good high-temperature performance with long shelf life for pre-impregnated glass stock. ***J. L. Welch.*** *Product Engineering*, v. 30, no. 35, Aug. 31, 1959, p. 38-39.

13551* Stabilization of PVC Towards Sunlight. Effect on light stability of various vinyl compounding ingredients in use today was evaluated. Study was also given to the role of resin, plasticizer, opacifiers, and auxiliary light stabilizers. ***Norman L. Perry.*** *SPE Journal*, v. 15, July 1959, p. 550-555.

13552* Polyvinyl Alcohol—A Versatile Synthetic Polymer. General properties and its current and potential utilization in various branches of the processing and specialties industries. ***C. P. Argana.*** *Soap and Chemical Specialties*, v. 35, Aug. 1959, p. 46 + 3 pages.

13553* PVP's Use in Specialties Grows. Polyvinylpyrrolidone's growing use, applications in specialties, ranges from detoxifying iodine-type sanitizers to anti-soil redeposition in detergents. ***Julian L. Azorlosa.*** *Soap and Chemical Specialties*, v. 35, Aug. 1959, p. 51 + 4 pages.

13554* Carbochain Polymers and Copolymers. X. Block Polymerization of Methylmethacrylate in the Presence of Tributylboron. XI. The Synthesis, Polymerization and Copolymerization of Esters of Vinylphosphinic Acid. (*In Russian.*) Karbotseptnye polimery i sopolimery. X. Polimerizatsiia metilmetakrilata v bloke v prisutstvii tributilbora. ***G. S. Kolesnikov and N. V.* Klimentova.** XI. Sintez, polimerizatsiia i sopolimerizatsiia efirov vinilfosfinovoĭ kisloty. ***G. S. Kolesnikov, E. F. Rodionova, and L. S. Fedorova.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 3, Mar. 1959, p. 362-372.

13555* Copolymerization of 1,3-Butadiene and 2-Methyl-5-vinylpyridine. Copolymerization constants and copolymer composition were calculated. (*In Russian.*) Sovmestnaia polimerizatsiia butadiena-1.3 s 2-metil-5-vinilpiridinom. I. Konstanty sopolimerizatsii i sostav sopolimerov. ***V. L. Tsailingol'd, M. I. Farberov, and G. A. Bugrova.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 3, Mar. 1959, p. 415-419.

13556* Polymerization of Styrene by the Simultaneous Action of Catalyst and Light. In the polymerization of styrene by the simultaneous action of $SnCl_4$ and light the tetrachloride was reduced to the dichloride. (*In Russian.*) Polimerizatsiia stirola pri odnovremennom vozdeĭstvii katalizatora i sveta. ***E. V. Zabolotskaia, A. P. Gantmakher, S. S. Medvedev.*** *Vysokomolekuliarnye Soedineniia,* v. 1, no. 3, Mar. 1959, p. 460-465.

See also: **12588** (polymer analysis); **12719** (heat fusible Teflon tape); **12740** (silicones).

POLLUTION AND WASTES

13557 Dust Removal Plant at the Bochumer Verein LD Steelworks. Equipment selected for gas cleaning at the new steelworks of Bochumer Verein, consisting of two 35-m. ton LD vessels and one 75-m. ton arc furnace. ***R. Harr, K. Wagner, and T-H. Willmer.*** *Henry Brutcher Translation No.* 4646, 11 pp. (From *Berg- und Hüttenmännische Monatshefte,* v. 104, no. 2, 1959, p. 50-55.)

13558* Treatment of Phenolic Wastes. Different kinds of treatment are discussed and results cited. ***G. Gutzeit, E. J. Lyons, and D. C. MacLean.*** *Industrial Wastes,* v. 4, no. 4, July 1959, p. 57-60.

13559 Symposium on Radioactivity in Industrial Water and Industrial Waste Water. 69 pp. 1958. American Society for Testing Materials, Philadelphia. (TD898 Am35s)

13560* Water Quality Criteria as They Relate to Beneficial Water Uses. Proposes that rational management of quality in either fresh or salt water be accomplished through determining and enunciating present and future beneficial water uses which are to be preserved and protected; determining and adopting water quality criteria to protect these uses, but which at the same time allow maximum use and re-use of the waters; and establishing monitoring to measure maintenance or meeting of the water quality criteria. ***Vinton W. Bacon.*** *Tappi,* v. 42, July 1959, p. 137A-143A.

13561* A New Technique for the Evaluation of Paper Mill Toxicants. The test involves an attempt to simulate, as closely as possible, conditions in the paper machine system while maintaining adequate simplicity in design so as to facilitate the practical running of a large number of tests. The contact environment is mill white water and the inoculum is a mixture of organisms (10^6 to 5×10^7 per flask) in a slime sample taken directly from an area of accretion in the paper machine itself. Measurement of effectiveness is made by weighing the amount of slime adhering to receptor sticks placed in the contact medium for a period of 48 hrs. ***Arthur M. Stern.*** *Tappi,* v. 42, July 1959, p. 605-609.

See also: **12506** (microbiology text book); **12803** (plating waste treatment plant); **12804** (plating waste recovery system); **12805** (plating waste disposal); **12916** (automobile exhaust gases and air pollution); **12940** (weather modification and smog); **13123** (elimination of steel converter fumes).

RUBBER AND ELASTOMERS

13562 Synthetic Rubber for Self-Sealing Fuel Tanks. Copolymer of butadiene-methylpentadiene applied to self-sealing fuel tanks. ***Lawrence Spenadel and Robert J. Good.*** *Industrial and Engineering Chemistry,* v. 51, Aug. 1959, p. 935-936.

13563 Cyanosilicone Elastomers. These elastomers show new combinations of solvent resistance and low-temperature flexibility, retain characteristic high-temperature oxidative stability of silicones. ***T. C. Williams, R. A. Pike, and F. Fekete.*** *Industrial and Engineering Chemistry,* v. 51, Aug. 1959, p. 939-940.

13564 Kinetics of Filler-Polymer Interaction Between Fine Particle Silica and SBR or Butyl Rubber. Hi-Sil 233, a fine particle silica, undergoes chemical filler-polymer interaction similar to HAF carbon blacks, indicating a need to consider this silica white filler as a potential highly reinforcing agent. ***Melvin P. Wagner and John W. Sellers.*** *Industrial and Engineering Chemistry,* v. 51, Aug. 1959, p. 961-966.

13565* The Reaction of Sulfur and Sulfur Compounds With Olefinic Substances. XII. Effects of Vulcanizing Additives on the Reaction of Sulfur With 2,6-Dimethylocta-2,6-diene, and Their Bearing on the Mechanism of Sulfur Vulcanization of Natural Rubber. ***L. Bateman, R. W. Glazebrook, and C. G. Moore.*** *Journal of Applied Polymer Science,* v. 1, no. 3, May-June 1959, p. 257-266.

13566* Molecular Weights of Polymethyl Methacrylate in Rubber-Methyl Methacrylate Graft Copolymers. ***W. Cooper, G. Vaughan, and R. W. Madden.*** *Journal of Applied Polymer Science,* v. 1, no. 3, May-June 1959, p. 329-335.

13567* The Mechanism of Radiation Damage to Elastomers. I. Chain Scission and Antirad Action. Information concerning the effects of antirads upon chain scission induced by high energy gamma radiation. Stress relaxation measurements were chosen as the measure of chain scission. ***Richard G. Bauman and John W. Born.*** *Journal of Applied Polymer Science,* v. 1, no. 3, May-June 1959, p. 351-355.

13568* Graft Polymerization of Methyl Methacrylate With Natural Rubber in Emulsion. Two new methods of grafting methyl methacrylate to natural rubber in latex form. ***C. C. Menon and S. L. Kapur.*** *Journal of Applied Polymer Science,* v. 1, no. 3, May-June 1959, p. 372-373.

13569* Radiation Vulcanization of Polydimethyl Siloxane Rubber. For this short period process no peroxide vulcanizing agents, no high temperature, and no subsequent maintenance in the thermostat are necessary. The degree of vulcanization is easily controlled and only a relatively small integral dose is required. Carbon black can be used as filler. Advantages of siloxane rubber obtained by long time thermal aging in comparison with peroxide vulcanized rubber. (*In Russian.*) Radiatsionnaia vulkanizatsiia polidimetilsiloksanovogo kauchuka. ***L. A. Oksent'evich, T. S. Nikitina, and A. S. Kuz'minskiĭ.*** *Kauchuk i Rezina,* v. 18, no. 5, May 1959, p. 21-26.

13570* Applying Sulfenamide Accelerators to Tire Vulcanization. In mixtures made of natural rubber, the sulfenamide vulcanization accelerators considerably increase the modulus and the resistance to rupture of the vulcanized rubbers in comparison with captax. (*In Russian.*) Primenenie sul'fenamidnykh uskoriteleĭ dlia vulkanizatsii shin. ***M. S. Fel'dshtein, E. A. Pakhomova, S. K. Aganina, and I. I. Eĭtingon.*** *Kauchuk i Rezina,* v. 18, no. 5, May 1959, p. 35-40.

13571 How to Interpret Mechanical Properties of Elastomers. Summary of some of the standard tests used and interpretation of results. *Materials in Design Engineering,* v. 50, Aug. 1959, p. 105-109.

13572* Constitution and Variability of Rubber From Individual Trees. Variations in rubber from individual trees which was obtained by the use of special procedures designed to obtain pertinent information on several important variables under consideration. ***A. R. Kemp.*** *Rubber Age,* v. 85, no. 5, Aug. 1959, p. 773-782.

13573* Determining the Bound Styrene in Styrene-Butadiene Copolymers. Streamlined method involving nitration and spectrophotometric analysis. ***C. L. Hilton.*** *Rubber Age*, v. 85, no. 5, Aug. 1959, p. 783-785.

13574* A Modified Rebound Pendulum for Evaluating Flexible Foams. ***L. A. Rosenthal and G. I. Addis.*** *Rubber Age*, v. 85, no. 5, Aug. 1959, p. 790-794.

13575* Molding of Resilient Urethane Foams. Article covers basic steps in continuous urethane foam production; pinpoints the variables involved in this production and some ideas on their control. ***R. E. Knox and W. J. Touhey.*** *Rubber World*, v. 140, no. 5, Aug. 1959, p. 711-716.

13576* New Extrusion Techniques With Silicone Rubber. ***H. H. Bashore, E. G. Schwarz, and C. E. Simpson.*** *Wire and Wire Products*, v. 34, Aug. 1959, p. 960 + 3 pages.

SPACE HEATING AND CONDITIONING

13577* Air Conditioning Printing Plants. Recommended procedures and equipment types are described. ***Richard S. Arnold.*** *Air Conditioning, Heating and Ventilating*, v. 56, Aug. 1959, p. 53-58.

13578* Ventilation for Telephone Exchanges. Control of humidity and dust has been studied by the Bell Telephone Laboratories for the best operating environment for automatic telephone switching equipment. Ventilation conditions are given for summer and winter operation, and a tool described for dust evaluation. ***Harvey C. Rossing.*** *Air Conditioning, Heating and Ventilating*, v. 56, Aug. 1959. p. 59-61.

13579* Air Filter Selection Data. Data for various filter types are given. *Air Conditioning, Heating and Ventilating*, v. 56, Aug. 1959, p. 62-63.

13580* Solar Radiation and Walls Facing North and South. Completes study of solar radiation as received on vertical surfaces of the four cardinal points at the U. S. Weather Bureau's Solar Radiation Observing Station at Blue Hill Observatory, Milton, Massachusetts. ***Charles V. Cunniff.*** *Air Conditioning, Heating and Ventilating*, v. 56, Aug. 1959, p. 64-67.

13581* Achieving Economy in the Design and Use of Heat Pumps. Methods of design and operation are considered for various types of systems, with information on air distribution, compression, defrosting methods and controls. ***J. R. Harnish.*** *Air Conditioning, Heating and Ventilating*, v. 56, Aug. 1959, p. 69-80.

13582 Expansion Machines for Low Temperature Processes. Development of engines for refrigerative purposes and also of their application to many low-temperature processes. ***S. C. Collins and R. L. Cannaday.*** 115 pp. + 8 plates. 1958. Oxford University Press, London. (TP495 C69e)

13583* Breakthrough in Air Conditioning: Low-Cost 500-House Project Offers Central Cooling as Standard Equipment. The Homestead development in Columbus, Ohio, includes complete year-round air conditioning at no extra cost in all of its homes, priced from $13,750 to $15,250. *Heating & Air Conditioning Contractor*, v. 50, no. 11, Aug. 1959, p. 49-53.

13584 Packaged Units Cool 33-Year-Old, 11-Story Office Building. Installation of biggest packaged job completed in three construction stages. ***R. G. Hurstad.*** *Heating, Piping & Air Conditioning*, v. 31, Aug. 1959, p. 85-87.

13585 Many Ways to Use Heat Pump Cycle. Describes various heat pump operating cycles and weighs the merits and possibilities of this type of system, citing installation and operating cost figures from existing installations. ***E. R. Ambrose.*** *Heating, Piping & Air Conditioning*, v. 31, Aug. 1959, p. 90-93.

13586 Corrective Water Treatment Prevents Scale Deposit, Corrosion in Water Cooled Air Conditioning Systems. Scale prevention in air washer systems, chilled water systems, and condenser-compressor cooling water systems. ***J. L. Thornley.*** *Heating, Piping & Air Conditioning*, v. 31, Aug. 1959, p. 112-115.

13587 How to Design Refrigerant Piping. Describes the pipe joining techniques which should be followed to obtain the tightness and strength that are so vital to successful operation. ***W. C. Smith.*** *Heating, Piping & Air Conditioning*, v. 31, Aug. 1959, p. 116-118.

13588 Controlling 100 Percent Outdoor Air Systems With Electronic Controls. Five outdoor makeup air systems are described along with a general description and operating sequence for each. ***James Busch.*** *Heating, Piping & Air Conditioning*, v. 31, Aug. 1959, p. 119-122.

13589 Cooling the I=B=R Research Home With a Chilled-Water, Fan-Coil System. ***Warren S. Harris, Norman B. Migdal, and Glenn R. Sward.*** *Illinois, University, Engineering Experiment Station Bulletin No.* 451, July 1958, 32 pp. (Tl 16b Vis.)

13590 Mechanical Refrigeration. ***Norman R. Sparks and Charles C. Dillio.*** 2nd Ed. 283 pp. 1959. McGraw-Hill, New York. (TP492 Sp26m2)

13591 Development of New Sound Absorbing Materials for Noise Suppressors. I. Development of Equipment for Evaluating Acoustical and Durability Properties of Sound Absorbing Materials at Elevated Temperatures. ***William E. Lawrie.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 58-460, June 1959, 64 pp. (TL507 Un3.18w Vis.)

See also: **12935** (mine dust control); **12937** (dust control in mineral processing).

TEXTILES, FIBERS, LEATHER, AND PAPER

13592* Effects of Gamma Radiation on Collagen. The shrinkage temperature decreased and water solubility increased even at low radiation levels. Relatively little damage to amino acid structure was observed at absorption doses less than 20 megarads. Amino acid components most susceptible to alteration by radiation are methionine, phenylalanine, and threonine, while those least damaged were alanine, glycine, hydroxyproline, proline, and arginine. Radiation causes a non-hydrolytic type of peptide chain scission. ***J. Cassel.*** *American Leather Chemists Association, Journal*, v. 54, Aug. 1959, p. 432-451.

13593* Examinations on the Ageing Behaviour of Various Impregnated Glass Cloths (Containing Alkali). Aging causes a very rapid decrease of the tensile and bending strengths and abrasion resistance by weathering. Heat-treated glass cloth shows essentially more equalized values. (*In German.*) Untersuchungen über das Alterungsverhalten verschieden imprägnierter Glasgewebe (alkalihatig). ***Wolfgang Bobeth and Ursula Renner.*** *Faserforschung und Textiltechnik*, v. 10, July 1959, p. 263-270.

13594* The Production of Nutritional Yeast From Spent Sulfite Liquor. Production of edible protein from spent sulfite liquor was developed in Germany. To be competitive, costs must come down or markets open up. ***J. M. Holderby and W. A. Moggio.*** *Forest Products Journal*, v. 9, June 1959, p. 21A-24A.

13595* Utilizing Lignosulfonates From Spent Sulfite Liquor. Lignosulfonates are the main component of spent sulfite liquor—50 to 60% of the dry solids. Food-grade vanillin is the most successful cleavage product, but a large market for intermediates in the chemical fields has not yet materialized. ***J. R. Salvesen.*** *Forest Products Journal*, v. 9, June 1959, p. 25A-27A.

13596* Effect of Several Variables on Quality of Rotary-Cut Veneer. The general approach in this research was to study the effect on veneer quality of variations in knife angle, horizontal nosebar opening, and vertical nosebar opening of

the lathe and to determine the most satisfactory combination of these variables for each log. Greatest influence of knife angle is on uniformity of veneer thickness. Nosebar compression affected veneer thickness, tightness, and smoothness. Cold cutting reduced tensile strength to less than 30% of controls. ***F. F. Wangaard and R. P. Saraos.*** *Forest Products Journal,* v. 9, June 1959, p. 179-187.

13597* Natural Durability of Diamond Willow Heartwood. Willows with diamond-shaped cankers on the stem show natural durability. Toxic extracts were separated by ion-exchange and paper chromatography techniques and evaluated against wood destroying fungi. ***P. M. Opsal and R. L. Hossfeld.*** *Forest Products Journal,* v. 9, June 1959, p. 188-192.

13598* Dynamic Mechanical Properties of Nylon 66 and the Plasticizing Effect of Water Vapor on Nylon. II. Functions of relative humidity for nylon 66 at 9 and 60 C. ***J. M. R. Quistwater and B. A. Dunell.*** *Journal of Applied Polymer Science,* v. 1, no. 3, May-June 1959, p. 267-271.

13599* The Occurrence of Insect Parasites of *Choristoneura fumiferana* (Clem.), in Oregon. Thirty-four species of primary parasites have been recovered from the spruce budworm. During the period 1953-56, seven species increased in density without decreasing in presence, and three species increased in presence without decreasing in density. Secondary parasitization is suggested as a factor retarding the increase in density of primary parasites during the early stages of an outbreak. ***V. M. Carolin and W. K. Coulter.*** *Journal of Economic Entomology,* v. 52, no. 4, Aug. 1959, p. 550-555.

13600* Timber Stand Maps, Plotless Cruising, and Business Machine Computation as Elements of a Timber Survey Method. ***Thomas J. Orr.*** *Journal of Forestry,* v. 57, Aug. 1959, p. 567-572.

13601* A Method for Measuring Cutting Force in Frame Sawing. The fundamental idea of the method lies in determining the components of the cutting force by measuring the reacting forces that they generated in the wood being sawed. ***Eero Kivimaa.*** *Microtecnic* (English Edition), v. 13, no. 2, Apr. 1959, p. 88-92.

13602 Symposium on Paper and Paper Products. New developments, with accompanying requirements for new testing methods. 73 pp. 1959. American Society for Testing Materials, Philadelphia. (TS1109 Am35s)

13603* What Are the Wood Properties Required by the Paper Industry in the Trees of the Future? In tree breeding work for the paper industry, cell length, which is correlated with cellulose content, and basic density, which is a good index of cell wall thickness, are characteristics that must be taken into account. A method of determining wood properties in those trees selected by foresters as possible parents is briefly described, and examples given of the way each tree can be assessed in relation to the average and extremes for the species. ***H. E. Dadswell, A. J. Watson, and J. W. P. Nicholls.*** *Tappi,* v. 42, July 1959, p. 521-526.

13604* A Study of Curl in Decorative Laminates. Problems relating to the warping of high pressure decorative laminates are discussed with particular reference to processing and environmental factors as well as different types of phenolic resins. The differential in shrinkage between the melamine decorative sheet and the phenolic core with moisture changes are shown to be critical. ***W. E. Morris and J. M. Verdi.*** *Tappi,* v. 42, July 1959, p. 583-587.

See also: 12465 (agricultural residues for viscose-grade pulp).

WELDING AND JOINING

13605 Arc-Welding Low-Alloy Steels. This booklet is about the low-alloy medium-tensile structural steels, used in the as-rolled or normalized condition in the form of plate, flat bar and rolled section. The yield strengths of these steels are in the range 20-40 tons/sq. in. ***B. J. Bradstreet.*** 20 pp. July 1957. British Welding Research Assn., London. (Pamphlet)

13606 Brazing. This booklet, a guide to available brazing methods, and to the metals and types of joints most suitable for brazing. ***E. B. G. Trehearne.*** 28 pp. July 1956. British Welding Research Assn., London. (Pamphlet)

13607 Welding of Metals by Friction. Russian pioneering work on use of frictional heat for welding metals. Productivity and economy of friction welding compared with fusion welding. ***V. I. Vill'.*** *Henry Brutcher Translation No.* 4502, 18 pp. (From *Svarochnoe Proizvodstvo,* Sept. 1957, no. 9, p. 19-23.) Henry Brutcher, Altadena, Calif.

13608 Electrical Characteristics and Equipment for Argon-Arc Welding Aluminium. The electrical characteristics of both arc and power circuit are discussed, and reference is made to the methods adopted in commercial equipment. ***L. H. Orton and J. C. Needham.*** 20 pp. Feb. 1957. British Welding Research Assn., London. (Pamphlet)

13609 Heat Treatment of Welded Constructions. This booklet is concerned with the heat treatment of welded constructions in mild steel and low-alloy steels. ***P. H. R. Lane.*** 28 pp. Dec. 1956. British Welding Research Assn., London. (Pamphlet)

13610 Metallurgical Considerations in the Argon-Arc Welding of Aluminium. This booklet is part of a series forming a complete handbook on the A-arc welding of Al alloys. ***J. E. Tomlinson and J. G. Young.*** 29 pp. Mar. 1957. British Welding Research Assn., London. (Pamphlet)

13611 Inert-Gas Brazing Room Proposed. Aerospace Industries suggests manufacturers study joint establishment of "space room" for high-temperature work on metals. *Missiles and Rockets,* v. 5, no. 32, Aug. 3, 1959, p. 22.

13612 The Principles of Argon-Arc Welding Aluminium. ***P. T. Houldcroft.*** 18 pp. Mar. 1957. British Welding Research Assn., London. (Pamphlet)

13613 Today's Rules for Rubber-to-Metal Bonding. The bonding technique will now join almost any metal to nearly any kind of rubber. Aided by newer adhesives, the method has proven itself in the last five years—and here's a timely report on how to obtain reliable bonds and desired tolerances. ***Roland Fisch and Edward Amann.*** *Product Engineering,* v. 30, no. 31, Aug. 3, 1959, p. 52-54.

13614 Resistance Welding. This booklet is a guide to the various resistance welding processes and the way they may be best used to weld the various ferrous and nonferrous metals. ***J. E. Roberts.*** 46 pp. Dec. 1956. British Welding Research Assn., London. (Pamphlet)

13615* Considerations Concerning the Rectifying Effect When Welding With An A-C Electric Arc. Thermionic-emission of electrons from the cathode. Causes of the rectifying effect. Experimental investigations with a WIG welding plant. Arc current and arc voltage. Determination of rectification ratio. Influence of high frequency upon rectification ratio. (*In German.*) Zum Gleichrichtereffekt beim Schweissen mit Wechselstrom-Lichtbogen. ***F. Bollenrath, K. H. Lindackers, and E. Roeder.*** *Schweissen und Schneiden,* v. 11, July 1959, p. 267-270.

13616* Welding and Inspection of Welds During the Construction of the Oil Pipe-Line Between Wilhelmshaven and Cologne. Technical specifications of the oil pipe-line. Steels used for the pipes and welding electrodes. Site welding. Root welding. Deposition of intermediate and top runs. Inspection of welded seam. (*In German.*) Schweissen und Schweissnahtprüfung beim Bau der Rohölleitung Wilhelmshaven-Köln. ***H. Winter.*** *Schweissen und Schneiden,* v. 11, July 1959, p. 270-279.

13617* Vertical Downward Welding in the Manufacture of Large Storage Tanks. Comparative experiments with vertical upward and downward welds applied to test sheets. Appearance of the seams. Measurement of angular and longitudinal contraction. Quality of the seam. Crystalline structure. Analysis of parent material and weld metal. Cost comparison between

the vertical upward and downward welded seams. (*In German.*) Das Fallnahtschweissen im Grossehälterbau. ***A. Buchholz.*** *Schweissen und Schneiden,* v. 11, July 1959, p. 285-288.

13618* Tooling for Automatic Arc Welding. Automatic or semiautomatic welding can bring substantial cost savings to high-volume production operations. Describes how each process can be used to best advantage and supplies a check list to help determine process selection. ***R. A. Wilson.*** *Tool Engineer,* v. 43, no. 2, Aug. 1959, p. 69-72.

13619 Development of Notch-Ductile Stress-Relieved Weld-Metal for the Fabrication of Dynamically-Loaded T-1 Steel Structures. A notch-sensitive fusion-zone observed in stress-relieved T-1 steel welds was attributed to chemical incompatibility resulting from liquid dilution and partial solid state diffusion of the weld-base metal-complex. Electrodes were developed capable of depositing compatible stress-relieved weld-metal yielding uniform energy absorption values, equivalent to those observed in base-metal, through all zones across a T-1 weld-joint. ***J. S. Kobler.*** *U. S. Department of the Navy, Bureau of Ordnance, NAVORD Report* 6491, Apr. 30, 1959, 33 pp. (TL570 Un3.55n Contin.)

13620 How to Get Better Stainless Steel Welds. Even though each stainless welding job poses its own problems, there are certain basic fundamentals which apply to the welding of any stainless steel. To know these fundamentals, and to put them into constant practice, is to create the difference between success or failure on any job. ***W. L. Wilcox.*** *Welding Engineer,* v. 44, Sept. 1959, p. 32-34.

13621 Spot Welding Procedures and Design. I. Popularity of spot welding is based not only on its economy, but also on minimum metallurgical disturbances in its weld areas. Since there is a direct relationship between weld strength and joint design, the latter assumes considerable importance in obtaining satisfactory joints. ***Lester F. Spencer.*** *Welding Engineer,* v. 44, Sept. 1959, p. 35-39.

13622* Understanding Weld Distortion and Shrinkage. Most causes of distortion and shrinkage can be determined if weld heat is first understood. ***George W. Gardner.*** *Welding Engineer,* v. 44, Sept. 1959, p. 40-42.

13623 Tig Welding, Aluminum Used to Manufacture Durable and Economical Transformer Cases. Aluminum transformer cases overcome the rusting usual on the West Coast. *Welding Engineer,* v. 44, Sept. 1959, p. 43.

13624 Modern Geodesic Dome Replaces An Old-Fashioned Railcar Repair Plant. Welding and thin sheet steel are used in this dome at Wood River, Illinois. *Welding Engineer,* v. 44, Sept. 1959, p. 44-45.

13625 Importance of Considering Welding Stresses Reviewed. Further explanation of residual stresses caused when welding, in answer to a letter which appeared in the July *Welding Engineer* as an aftermath to the original article on residual stresses which appeared in the June issue. *Welding Engineer,* v. 44, Sept. 1959, p. 48-49.

13626 Welding Helps Launch First Nuclear-Powered Merchant Ship. The *N. S. Savannah,* the world's first nuclear-powered merchant ship slipped down greased ways on July 21, opening the door to a new era in shipping. *Welding Engineer,* v. 44, Sept. 1959, p. 50-51.

13627 Hand Welding Still Most Economical in Many Cases. Despite the inroads automation has made, there are still a great many concerns—small and large alike—that use only manual welding to fabricate their products. *Welding Engineer,* v. 44, Sept. 1959, p. 52-53.

13628 When Refining Gasoline . . . Nickel-Alloy Lining Slashes Isomerization Unit Costs. Explains details of welding Ni-alloy lining in a 13,000 lb. vessel. ***John F. De Lorenzo.*** *Welding Engineer,* v. 44, Sept. 1959, p. 58 + 1 page.

13629 Upper Michigan School Supplying Area With Welders. ***Elmer J. La Branche.*** *Welding Engineer,* v. 44, Sept. 1959, p. 82.

13630 Welded-Steel Flat Cars Increase Piggyback Efficiency. The Atchison, Topeka and Santa Fe Railroad refined the piggyback idea by producing a huge specially designed, welded car that can accommodate two highway trailers. ***G. C. Shields.*** *Welding Engineer,* v. 44, Sept. 1959, p. 84.

13631 Giant Aluminum Dump Truck Bodies Mig Welded. The largest Al dump-truck bodies in the world roll off the production line at The Heil Co., Milwaukee—thanks to arc-cutting and welding equipment. ***Chauncy Hart.*** *Welding Engineer,* v. 44, Sept. 1959, p. 88.

13632 Welded Pipe to Avert Water Shortage in India. Concerns laying of pipeline to increase water supply of Bombay, India. ***William A. Heath.*** *Welding Engineer,* v. 44, Sept. 1959, p. 90-91.

13633* Recent Metal-Removal Developments With Compressed-Air Carbon-Arc Process. Edge preparation, defect removal, weld-deposit removal, and scarring operations. ***Myron D. Stepath, Homer B. Nelson, and Wm. J. Coughlin.*** *Welding Journal,* v. 38, Aug. 1959, p. 755-759.

13634* Welding of Fuels and Controls for Dresden Nuclear Power Station. Processes, materials and quality-control methods are described for fabricating Zircaloy-2 clad, U dioxide containing fuel elements and B-bearing stainless-steel control rods. Certain unique techniques were required in handling Zircaloy-2 in order to preserve its satisfactory corrosion resistance and favorable mechanical properties. Certain developmental aspects of end-closure welding are described. Welding of B-bearing stainless-steel control rods required special weld-junction geometries and techniques to overcome material brittleness and distortion. ***C. N. Spalaris and J. W. Weyers.*** *Welding Journal,* v. 38, Aug. 1959, p. 760-765.

13635* Welded Clad Steel Pipe for Reactor Construction. Results of test program indicate that, under production conditions normally existing in a field welding project, predictable and satisfactory joints can be made. ***William H. Funk.*** *Welding Journal,* v. 38, Aug. 1959, p. 766-771.

13636* Metallurgy of Bonding in Brazed Joints. II. Migration of the Filler Metal Into the Base Metal. Relationships between the metallurgical mechanisms involved and the mechanical properties of the brazed joints are investigated by the authors. ***Nikoljas Bredzs and Harry Schwartzbart.*** *Welding Journal,* v. 38, Aug. 1959, p. 305s-314s.

13637* Effect of Specimen Geometry on Charpy Low-Blow Transition Temperature. Investigation demonstrates that low-blow transition temperature, as determined by an easily executed variation of the standard technique for testing Charpy specimens is independent of notch and specimen geometry. ***George M. Orner.*** *Welding Journal,* v. 38, Aug. 1959, p. 315s-323s.

13638* Isotope Techniques for Inspection and Evaluation of Ship Welds. Although other fast and inexpensive inspection methods are being investigated, radiography with isotopes has demonstrated its capabilities as a flaw-detection method. ***E. L. Criscuolo.*** *Welding Journal,* v. 38, Aug. 1959, p. 324s-328s.

13639* Process Welding of Nodular and Gray-Iron Castings. Investigation is conducted to determine which procedure is best suited to the process welding of nodular and gray cast-iron parts under normal production-welding conditions. ***Benjamin Townshend and Ellis O. Porter.*** *Welding Journal,* v. 38, Aug. 1959, p. 329s-334s.

13640* Welding of Reinforcing Bars for Concrete Construction. Purpose of test program was to investigate the applicability of arc welding to the joining of reinforcing bars selected from random lots and representing hard, intermediate, and structural grades. ***J. F. Rudy, F. Suyama, and H. Schwartzbart.*** *Welding Journal,* v. 38, Aug. 1959, p. 335s-344s.

13641* Alloy Doubles Life of Brazing Retorts Used at 2300°F. An application of Hastelloy alloy X. *Western Metalworking,* v. 17, Aug. 1959, p. 43.

See also: **13036** (mechanics of adhesive joints); **13277** (structure of welds).

MISCELLANEOUS

13642* The What and How of Ultrasonics. Principles. Use in cleaning, gaging, flow detection, machining, welding, and other operations. ***S. Peter Kaprielyan.*** *Aircraft and Missiles Manufacturing*, v. 2, Sept. 1959, p. 6-12.

13643* Swords and Plowshares. A dollar spent on military R & D frequently produces just as much, or more, civilian benefit as a dollar spent for civilian R & D. Here are some examples. ***Claude Witze.*** *Air Force*, v. 42, Aug. 1959, p. 52-54.

13644* What Are Company Rights—When an Employee Gets a Patent? Does a company always have a right to inventions developed at its direction? Can an inventor keep his patent to himself even if he developed the idea at company expense? Recent court cases are clearing up some of the confusion that surrounds patents. Here are some examples, and some conclusions. ***Albert Woodruff Gray.*** *American Machinist*, v. 103, Aug. 10, 1959, p. 99-100.

13645* Coefficients in Certain Asymptotic Factorial Expansions. *T. D. Riney.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 511-518.

13646* On the Matrix Riccati Equation. *J. J. Levin.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 519-524.

13647* Some Properties of Functions Which Uniformize a Class of Simply Connected Riemann Surfaces. Defines a class of open simply connected Riemann surfaces, determines the type of a surface from this class, and obtains the forms and some properties of the uniformizing function and its derivative. Also, a proof is given to show that every mapping function of the form obtained defines a surface of this class. ***H. B. Curtis, Jr.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 525-530.

13648* Martingale Formulation of Ergodic Theorems. In this note, it is shown that individual ergodic theorems can be formulated as statements about the convergence a.e. of martingales with decreasing index on infinite measure spaces. ***Meyer Jerison.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 531-539.

13649* A Tauberian Theorem for Strong Riesz Summability. *Pramila Srivastava.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 540-544.

13650* On the Product of Semi-Groups of Operators. *H. F. Trotter.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 545-551.

13651* Disconjugacy of Second-Order Linear Differential Equations With Non-Negative Coefficients. *John H. Barrett.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 552-561.

13652* A New Inequality for the Green's Function. This note contains two new results on the Green's function of certain planar domains. One is concerned with the Green's function's boundary values, the other is an upper bound for the value at the pole of the "regular part" of the Green's function, an upper bound which is independent of the location of the pole. ***William C. Fox.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 562-569.

13653* On Monotone and Positive Solutions of Second Order Nonlinear Differential Equations. The author considers the behavior of solutions of $y'' + f(y, y')y' + g(y) = 0$ $(Y' = dy/dx)$ for large values of independent variable, assuming the existence of such solutions. ***John Jones, Jr.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 570-573.

13654* A Note on Extending Semicharacters on Semigroups. The purpose of this note is to give a necessary and sufficient condition for a semicharacter on a subsemigroup of a commutative semigroup G to be extendable to a semicharacter on G. ***Kenneth A. Ross.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 579-583.

13655* On Automorphic-Inverse Properties in Loops. Shows that an I.P. loop in which J is an antiautomorphism everywhere is Moufang, and that a C.I. loop in which J is an automorphism everywhere is an abelian group. ***R. Artzy.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 588-591.

13656* Submodules of Rings. *Carl C. Faith.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 596-606.

13657* A Probability Limit Theorem Requiring No Moments. *John G. Kemeny.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 607-612.

13658* A Note on the Action of *SO(3).* Proves the following theorem about the action of the 3-dimensional rotation group, $SO(3)$, as a topological transformation group. Theorem: If $(SO(3), C^n)$ denotes $SO(3)$ operating on a closed n-cell, then the orbit space $C^n/SO(3)$ is acyclic over the integers; that is, $H^i(C^n/SO(3);Z) = 0$ for $i > 0$. ***P. E. Conner and E. E. Floyd.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 616-620.

13659 Diffeomorphisms of the 2-Sphere. Proves the theorem: The space Ω of all orientation preserving C^∞ diffeomorphisms of S^2 has as a strong deformation retract the rotation group $SO(3)$. ***Stephen Smale.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 621-626.

13660* On the Topology of Tangent Bundles. *L. Auslander and R. E. MacKenzie.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 627-632.

13661* Equicontinuity and Almost Periodic Functions. *Robert Ellis.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 637-643.

13662* Weak *n*-Homogeneity Implies Weak (n-1)-Homogeneity. *Morton Brown.* *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 644-647.

13663* Some Semigroups on the Two-Cell. Description of a semigroup on the two-cell where the multiplication satisfies the following two conditions: one; for x and y in the boundary of the two-cell relative to the plane $xy = x$, and two; there is a zero but no other idempotent in the interior of the two-cell. ***Anne Lester.*** *American Mathematical Society, Proceedings*, v. 10, no. 4, Aug. 1959, p. 648-655.

13664* K-Sample Analogues of the Kolmogorov-Smirnov and Cramér-V. Mises Tests. The main purpose of this paper is to obtain the limiting distribution of certain statistics described in the title. ***J. Kiefer.*** *Annals of Mathematical Statistics*, v. 30, no. 2, June 1959, p. 420-447.

13665* The Supremum and Infimum of the Poisson Process. *Ronald Pyke.* *Annals of Mathematical Statistics*, v. 30, no. 2, June 1959, p. 568-576.

13666* Wood Moves Out of the Woods. It is almost as if a new material had been invented, such is the vigor in new wood structures and research. ***David Allison.*** *Architectural Forum*, v. 111, no. 2, Aug. 1959, p. 139-145.

13667 The Fine Art of Measurement. Objectives of measurement, evaluation of design procedures, natural transducers, Hall, Faraday and Kerr effects, primary standards, standards to replace judgments, absolute and relative accuracy are discussed. ***K. E. Gould.*** *Bell Laboratories Record*, v. 37, Aug. 1959, p. 283-290.

13668 Shopping Centers Take Opposite Paths. Toledo is attempting to revitalize its downtown area, while Atlanta merchants are going after the suburban market. *Business Week*, no. 1563, Aug. 15, 1959, p. 56-58.

13669 Small Labs Weigh New Pay Plans. This week Resins Research Laboratories Inc. (Newark, N. J.) is polishing up a new dividend plan for its 23 staffers. *Chemical Week*, v. 85, no. 7, Aug. 15, 1959, p. 35-37.